FEBRUARY 23, 1953

Electrical World

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A McGRAW-HILL PUBLICATION

VISIONEERING

New concept in industrial lighting brings better visual efficiency through...

1 Good Visual Screening

2 Good Lighting

3 [illegible] Paint[illegible]

page 100

Allis-Chalmers distribution regulator in a Minnesota distribution system.

Now you can solve voltage problems fast. Stocks of Allis-Chalmers power and distribution regulators located at 20 strategic points across the country assure fast, efficient delivery when you have voltage troubles. You can end complaints due to low voltage economically and start profits rising faster than ever before.

Allis-Chalmers 5/8% step voltage regulators have proved themselves in the twenty years since they were first introduced. They are low in cost. They are accurate and reliable. And now with the new stocking program, they are the fast answer to voltage problems as well.

Get Full Information

Get the full story on Allis-Chalmers power and distribution regulators. Call your nearest Allis-Chalmers district office today or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3933

FREE MAINTENANCE STICKERS PROVIDE HANDY SERVICE RECORD

You get an on-the-spot record of control settings with these handy, adhesive-backed stickers. They go on any type of regulator, giving all the room you need for a complete service record. Write on them in pen or pencil. Call your nearest A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Regulator Record

Date
Voltage Level ____ Volts
Voltage Band ____ Volts
Resistance Comp ____ Volts
Reactance Comp ____ Volts
Drag Pointers
Raise ____ Lower ____
Oil Tested ____ KV (Date ____)

ALLIS-CHALMERS
Originators of 5/8% Step Regulation

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Originators of 5/8% Step Regulation

Hildebrand, the Visioneer

The latest type of engineer is the visioneer or engineer for vision. The first one (he originated the name) is Paul Hildebrand, lighting director of Pennsylvania Power & Light Co, Allentown. He gives his concepts of the new profession in an article beginning on page 100.

Visioneering was born in the dawn about a year ago. Lying in bed blinded by the rising sun, Hildebrand started thinking of the difficult seeing conditions of many industrial workers. And these he finally decided could be solved by visioneering.

The industry first learned of visioneering at a committee meeting last spring of the Pennsylvania Electric Association. The idea caught hold immediately, and Hildebrand was deluged for repeat performances.

Visioneering on the March . . . Even since Hildebrand wrote the article in this issue, visioneering has made great progress. Recently at Wilkes College, Wilkes-Barre, the Northeastern Pennsylvania Optometric Society and the local section of the Illuminating Engineering Society co-sponsored the first industrial vision conference.

PP&L has also advised a test group of employees that they may take a standard visual screening test without charge. In its Luzerne Division small industrial customers will be offered a package job. A national paint company representative, a lighting expert of the utility, and a registered vision expert hired by the industrial company will make a study when requested. The recommendations of the panel will then be given the customer to study and act upon.

Once a Pre-Med . . . Hildebrand has been with PP&L since the mid-'20's when he joined the training course. Previously he had taken the pre-medical course at Muhlenberg College and claims to be the only such graduate who ever became a registered professional engineer. For over ten years lighting sales has been his field. Contrary to the belief of many, Hildebrand is not an Allentown native. Born in New York City and raised in Brooklyn, he first went to Pennsylvania to attend Allentown Prep.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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ALUMINUM . . . including the *ELECTRICAL WIRE* and *CABLE*

Aluminum Company of America's new headquarters, towering above Pittsburgh's Golden Triangle is a miracle of architecture in aluminum.

This 30-floor, aluminum sheathed structure is a glittering new symbol not only of growing Pittsburgh, but of the increasing use of aluminum itself.

Aluminum was used for all wire and cable conductors, conduit, raceways, connectors, lugs, junction boxes, and other electrical equipment. The Okonite Company supplied a major portion of the aluminum cable.

This installation is typical of Okonite's versatility in the manufacture of insulated cables. Extensive experience for many years with aluminum conductors has provided us with the widest background in the most advantageous applications of insulated aluminum cables for aerial, underground, or conduit installation.

Two new Okonite booklets describe recent developments resulting from our research and engineering experience with aluminum conductors:

Bulleti: EW-1062 discusses the installation and splicing techniques used on the first 15kv paper insulated aluminum conductor underground power cable.'

Bulleti: EW-1063 gives new information on the electrical and physical properties of insulated aluminum conductors particularly for use with electrical equipment.

Your request for these booklets will receive our prompt attention. The Okonite Company, Passaic, N. J.

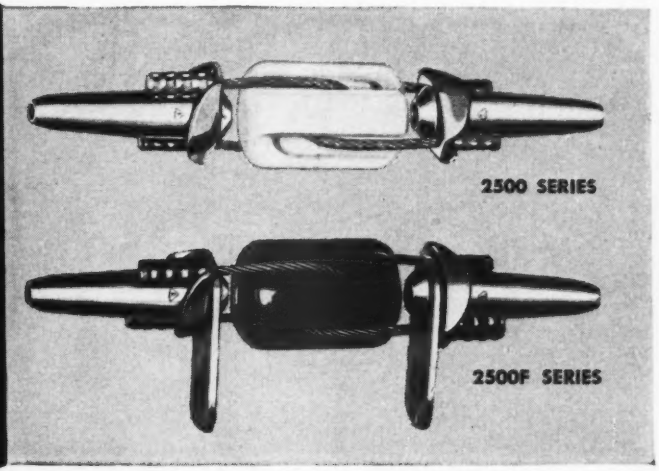
The best cable is your best policy

OKONITE OKONITE SINCE 1878 *insulated wires and cables*

for the largest number of line applications at the lowest possible cost...

USE *Electroline*

Insulating Automatic Line Splice SECTIONALIZERS



The Electroline Sectionalizers are assemblies that will function in service as most convenient, reliable and yet low cost interrupting devices. Series 2500-F and 2600 provide for paralleling with a fuse element for further protection when sectionalizing. The mechanical strength of these assemblies exceeds in all cases the rated breaking strength of the conductor for which they are adapted.

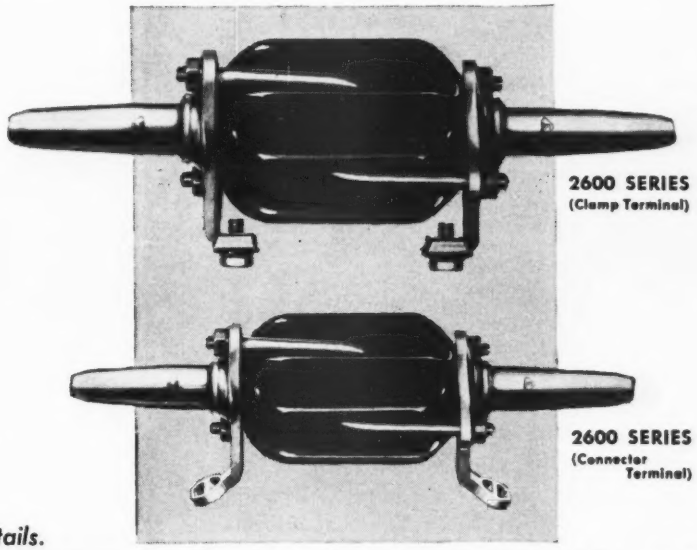
These Insulating Automatic Line Splice Sectionalizers are ideal for:

Installing Regulating Equipment,
simplifies cutting-in disconnecting points, fuses, voltage regulators and series capacitors;

Restoring Service,
providing points to test for trouble;

Sectionalizing Networks,
to readily isolate and test the area in trouble;

Series Street Lighting,
simplifies cutting-in series street lamps—merely cut the line and insert conductor ends into sectionalizer.



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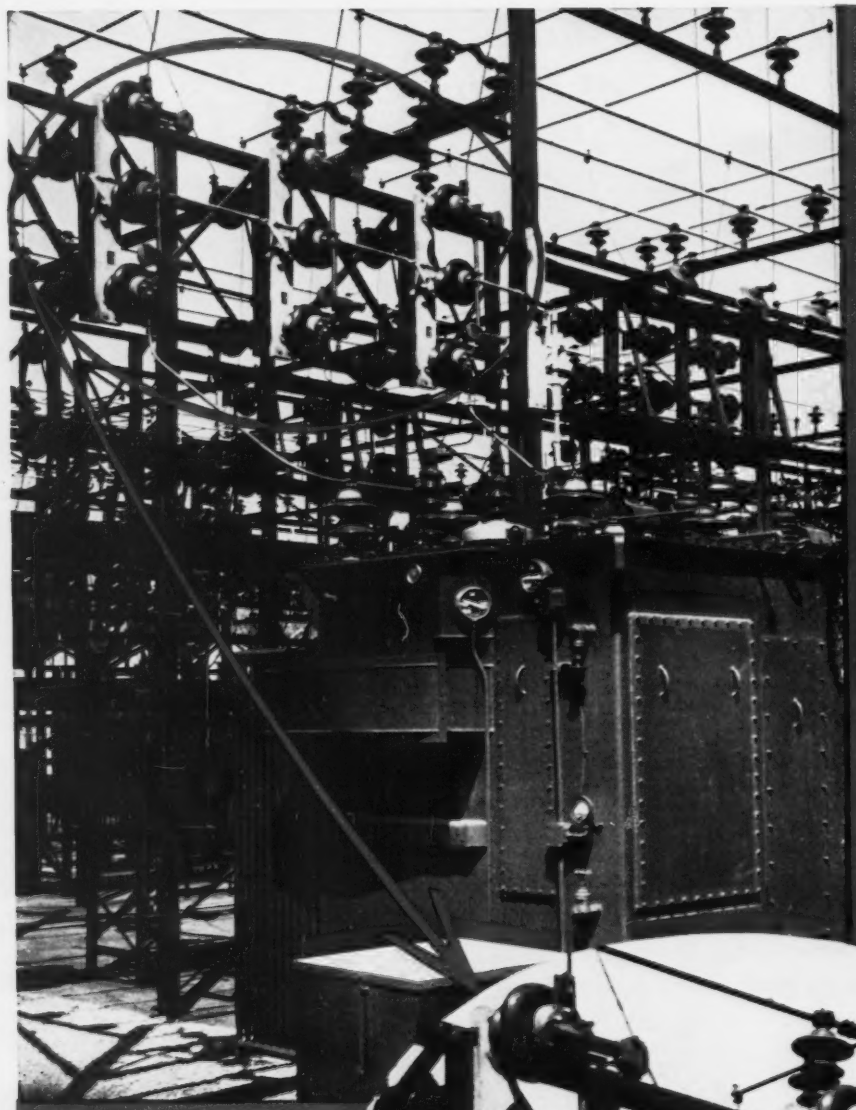
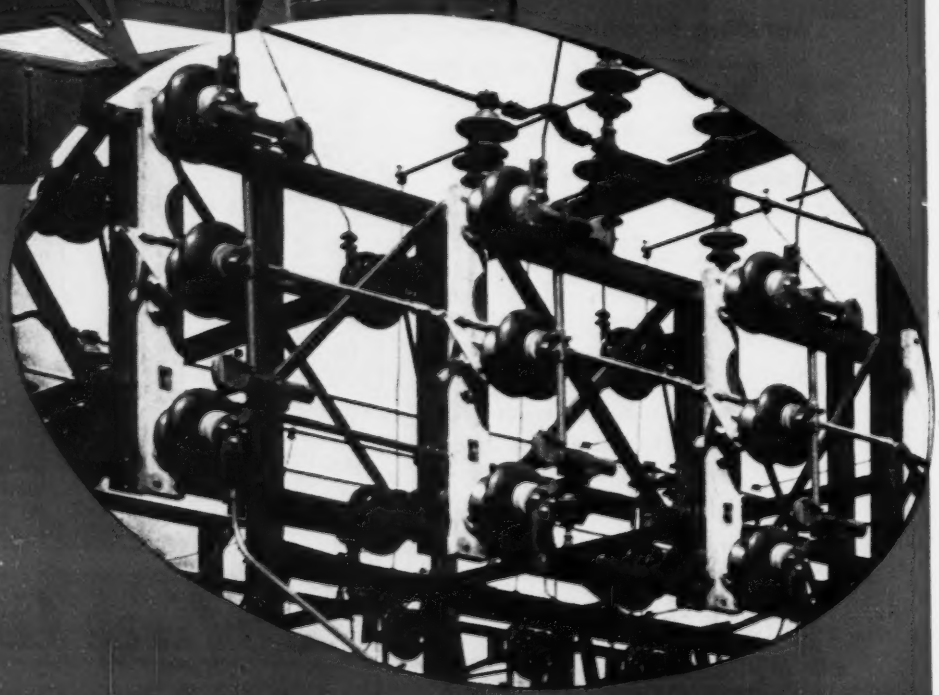


Save with

Typical of the economies made possible by Alduti Interrupter Switches is this installation in a substation serving a large mill.

When additional load capacity was required, Alduti Switches were mounted vertically on the existing structure directly under the overhead bus, and connected to the new transformer.

Note that if horn gap switches were used, it would be necessary to rebuild part of the structure—thus increasing capital investment substantially—because horn gap switches require upright mounting and considerable overhead clearance for arcing.



Capital Investment

Alduti* Interrupter Switches

They are taking the place of disconnect switches and horn gap switches because of their current interrupting capacity, and because their *confined-arc* operation permits vertical or inverted mounting—saves structure cost.

They are also taking the place of more expensive equipment . . . reducing investment . . . and providing safe, dependable interruption for high-voltage power circuits.

*Alduti is pronounced "All Duty" and signifies the ability of these switches to interrupt magnetizing and charging currents as well as 600-ampere load currents. It also signifies their wide applicability to sectionalizing, preferred-emergency throwover, bus transfer, capacitor bank switching, and to transformer primaries, transformer secondaries, and metal-clad applications such as power centers and unit substations.

ALDUTI INTERRUPTER SWITCHES encourage **NEW THINKING** in system layout, and show **NEW POSSIBILITIES** for versatility in arrangement, and for economy. May we send you this booklet containing **NEW CONCEPTS** of circuit interruption? A note to S&C on your letterhead will bring it.

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SPECIALISTS IN HIGH-VOLTAGE CIRCUIT INTERRUPTION

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TO YOUR **SELF-SUPPORTING AERIAL CABLES**

BY USING **Copperweld**™ TRADE MARK

NEUTRAL-MESSENGERS

YOU'LL CUT MAINTENANCE COSTS, TOO!

Throughout their long and trouble-free life, self-supporting aerial cables with Copperweld* Neutral-Messengers pay off in lower operating costs because of less maintenance and less time out. What's more, they assure better performance and increased service life.

Copperweld's molten-welded copper covering resists corrosion and furnishes the high conductance necessary for the return current. Its permanently protected steel core permits safer long spans—provides the strength to withstand heavy ice and wind loads.

Wherever Copperweld Messengers serve—and you'll find millions of feet in use—engineers will tell you that their aerial cables deliver dependable service with a minimum of maintenance.

Play Safe! Include "Copperweld Neutral-Messengers" in your specifications when ordering self-supporting aerial cables from your suppliers. Write us today for engineering data.

*Trade Mark

COPPERWELD STEEL COMPANY *Glassport, Pa.*

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Copperweld™ TRADE MARK *HIGH-STRENGTH, NON-RUSTING*

NEUTRAL-MESSENGERS

For Self-Supporting Cables

Action!

This Versatile Body is the STAR OF THE FIELD

A leading performer in supporting roles, too!

POWERS American

Series 350

LIGHT DUTY MAINTENANCE BODY

Utilities everywhere award the Series 350 an "Oscar" for efficiency. This versatile unit enables a two-man crew to perform maintenance and installation work normally requiring additional men and vehicles. The compact, fold-over derrick sets 40′ poles—a job which would otherwise require costly heavy-duty equipment. There's a 24′ ladder which can be quickly erected for overhead work. Compartments are equipped to carry tools and materials for many service operations. The under-floor winch is always ready to use—without moving material load. No wonder the Series 350 has been acclaimed "the most versatile performer in the field."

more utilities use POWERS-AMERICAN bodies than any other make

CLIP THIS COUPON and attach to your letterhead

McCABE-POWERS AUTO BODY COMPANY, 5901 N. Broadway, St. Louis 15, Mo.
Please forward details on SERIES 350. *Also send information on the following:*

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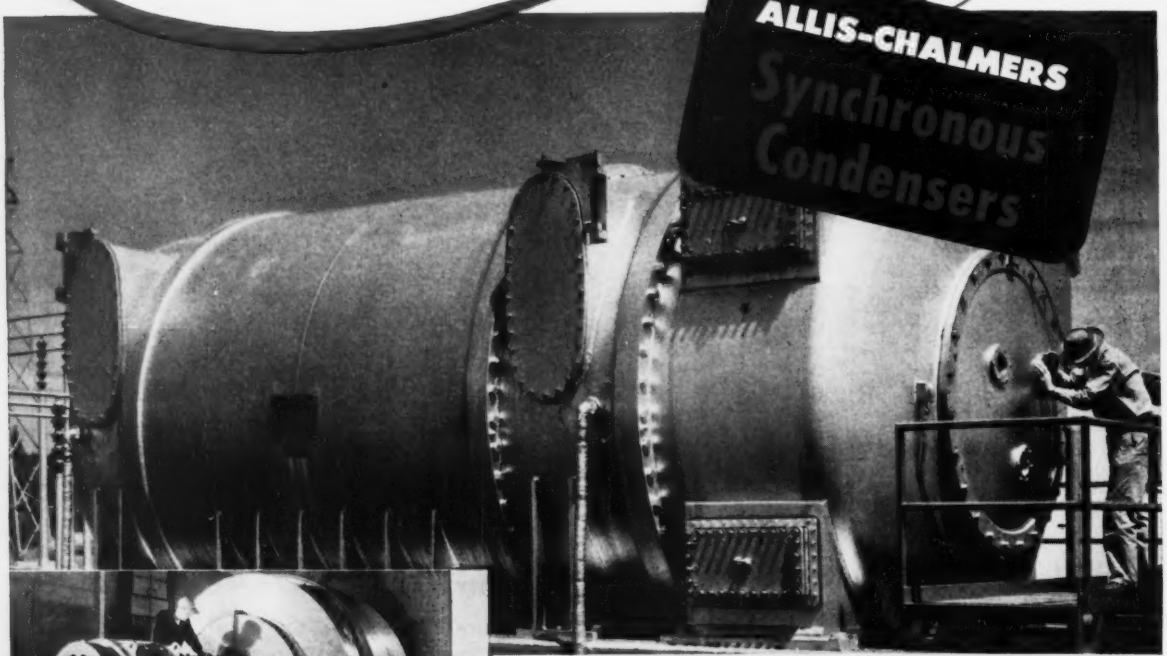

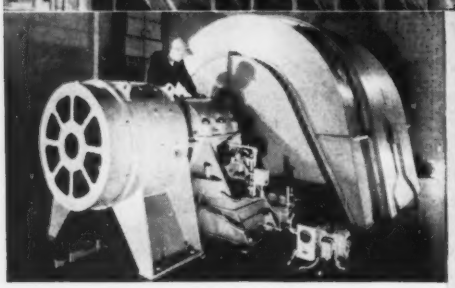

Pacific Coast system uses 50,000-kva hydrogen-cooled condenser (top view), and 20,000-kva air-cooled unit (bottom view).

Besides minimizing losses, hydrogen cooling results in a design suited to outdoor operation. Air-cooled units can also be built for outdoor use, and for industrial power-factor-correction applications.

Regulex amplifier control, which acts as both regulator and pilot exciter, is available for all synchronous condenser ratings.

Regulex is an Allis-Chalmers trademark.

FOR WIDESPREAD power systems, synchronous condensers can frequently be used in place of added or larger transmission lines. This is possible because, by supplying reactive kva, they assure efficient use of power lines.

But condensers can do more than just cut conductor requirements. They also provide voltage regulation on a wholesale scale, and furnish rotating inertia for improved system stability.

Custom-engineered to fill system requirements and to fit installation conditions, Allis-Chalmers synchronous condensers can help you hold down transmission costs. For more information on units for utility or industrial applications, call in your A-C representative, or write for Bulletin 05B7285. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3960

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PROTECTION FOR YOUR
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CRYSTAL VALVE VENTILATED GAP ARRESTER
High speed, multiple spark gaps kept free of corrosion by vents which permit movement of air and prevent accumulation of moisture in the housing. Glass housing makes gap inspection easy—condition of spark gap assembly readily seen at all times without removing arresters for testing. Amazing all-round performance is proved by thousands in service with almost 100% record of protection.
KEYSTONE EXPULSION ARRESTER
Enclosed series gap assures consistent operation . . . no line lockouts. Completely enclosed, this gap is not affected by weather elements, birds or other conditions. Vent passages in base seal, further assure that the body interior will be dry at all times. Safely withstands surge current far in excess of standard test value of 65,000 amperes of approximately 5 x 10 microsecond wave shape.
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Embodying time-proved multiple, spark gap units and electrodes with discharge surfaces that are smooth and flat. Oxidized Silicon Carbide valve element provides low voltage drop and adequate protection against surge voltage . . . extremely marked valve action in conjunction with spark gap assembly interrupts follow current . . . no measurable deterioration after years of service.
There's a Crystal Valve or Keystone Lightning Arrester to meet every protection problem . . . Write for complete catalog today.
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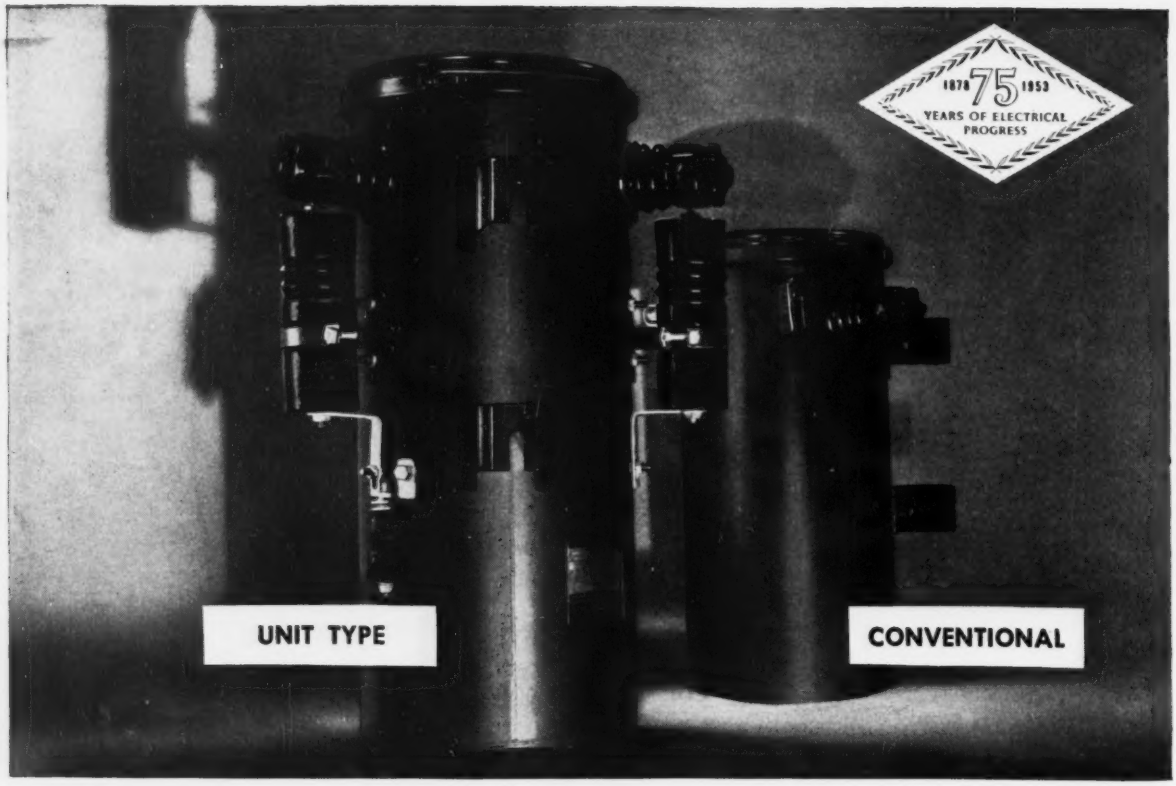

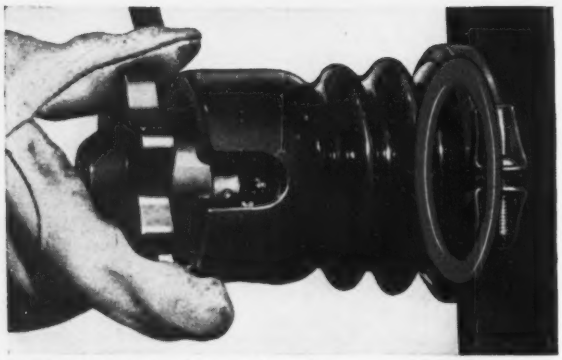

NITRILE SEAL (in red) is used on all openings—including bushings—to prevent breathing. An extra feature is non-rustable stainless steel band and Everdur bolt which clamp bushing to tank.

EXTERNAL GAP on G-E unit-type transformer isolates arrester from high-voltage lead. The gap keeps arrester at ground potential and prevents line grounding in event of arrester damage.

Easier to Connect Better Protected

New tank-wall high-voltage bushings on General Electric transformers—both conventional and unit type—make them easier to install. They permit faster, safer connections—without tools. Cable can be brought in from either side of the bushings, tightened quickly.

EXTERNAL GAP PROTECTS. On G-E unit-type transformers, the Pellet arrester is externally gapped to the new tank-wall bushing. This gap keeps the arrester at ground potential and prevents line grounding in case of arrester damage. And because the Pellet arrester is of the valve type which can't be eroded by discharge, it offers protection that lasts indefinitely. It can be installed anywhere on your system regardless of short-circuit currents.

Many ratings of these Spirakore* transformers with tank-wall high-voltage bushings can be shipped directly from one of G.E.'s warehouses near your locality. They're available in ratings 5 kv and below, 100 kva and below. For more information get in touch with your nearest General Electric representative. General Electric Company, Schenectady 5, New York. 431-2

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GENERAL ELECTRIC

DON'T WIND UP BEHIND THE

You can't be too particular what kind of wire and cable you buy. Lack of quality invites trouble. Trouble that brings unnecessary shutdowns, rising costs, and lower production rates. Why then get substitutes when you can install Simplex-Anhydroprene, the top quality wire and cable that assures you of longer-life and trouble-saving service.

Anhydroprene construction consists of a solid or stranded coated conductor, Anhydrex insulation, and a thin neoprene jacket. Light in weight and small in diameter, it is easy to handle and terminate. Anhydroprene resists oil, grease, corrosive chemicals, light and flame. With a high dielectric strength and low water absorption, this versatile wire operates at copper temperatures up to 167°F. (75°C.).

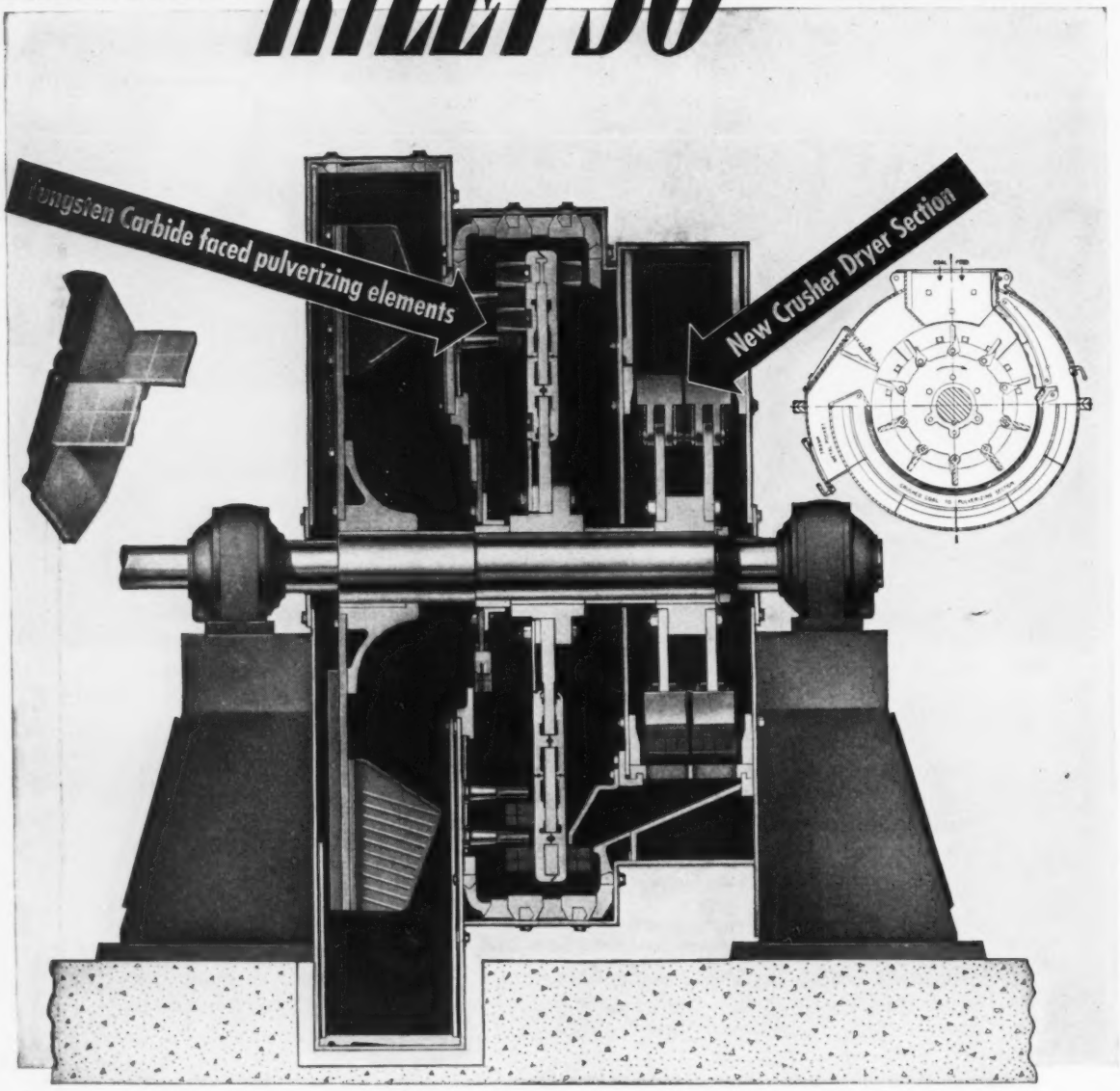
Designed for a variety of applications, Anhydroprene assures you of increased operating efficiency. All Anhydroprene wires and cables can be racked on walls, installed in conduits and used underground in ducts for plant and shop wiring, instrument wiring, underground primaries, transformer leads, pole line risers, signal and control circuits.

Why not call your Simplex representative or write in care of the address below for more complete information on the electrical and physical properties of Anhydroprene. No obligation of course.

Simplex - WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 SIDNEY STREET,
CAMBRIDGE 39, MASS.

The New "RILEY 50" Pulverizer



Pulverizing elements of the New Riley "50" Pulverizer are faced with tungsten carbide, assuring years of continuous service, low maintenance and sustained fineness without adjustments. The crusher-dryer section evaporates surface moisture so that moisture content of coal does not affect capacity. Foreign materials are also rejected in this section and coal is crushed to fine granular state, without damage to pulverizer.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

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Spontaneously Accepted by Engineers

Because of These Outstanding Features

1 No capacity reduction with increase in moisture.

2 Tramp iron, iron pyrites and other foreign materials in coal rejected.

3 Pulverizing elements faced with tungsten carbide.

4 Fineness sustained over years of operation.

5 Long periods of operation without necessity of shutdowns.

6 Unusually high capacity per unit of space.

7 Minimum foundation requirements.

8 Ability to carry low loads.

9 Flexibility-wide load range.

10 Operates without coal, with no noise and without wear or damage to parts.

11 Low maintenance and power.

12 No explosion hazard, travel of coal through pulverizer faster than flame propagation.

13 Quiet vibrationless operation.

14 Ease of lighting and regulation.

15 High primary air temperatures.

16 Thoroughly dependable.

17 Negligible cost of lubrication.

18 All moving parts on a single horizontal shaft with bearings outside of housing. No worms or gears.

19 Primary air fan integral with pulverizer —separate fan and motor not required.

All of these people have ordered Riley "50" Pulverizers within the past two years

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. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

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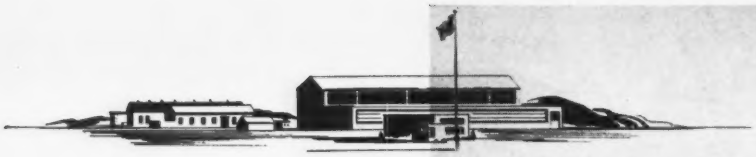


From B&W Research and Development . . .

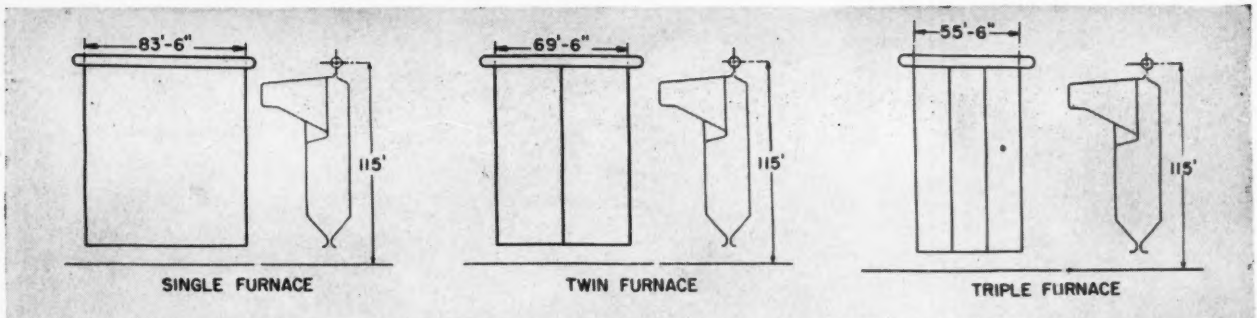
a practical solution to cost problems...

B&W DIVIDED

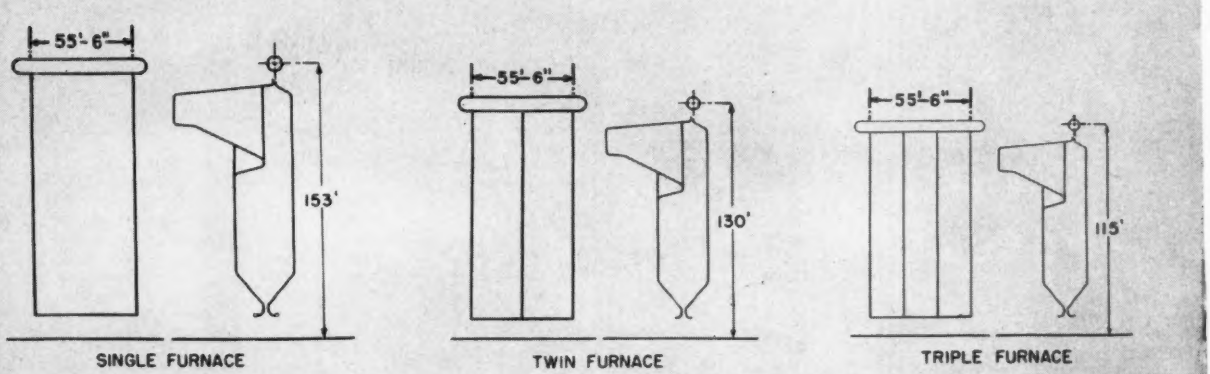
A practical, long-proved solution to rising construction costs may be found in the B&W Divided-Furnace Boiler. Whether it is a problem of conserving height, width, or both—especially for units with large heat input—B&W's Divided-Furnace design offers remarkable economies. The sketches on the opposite page show typical savings in space for twin-furnace and triple-furnace construction as compared with single-furnace construction.

A furnace division wall receives heat from both sides and therefore must be assured an adequate supply of water. With the B&W Cyclone-Steam Separator, circulation in division walls of B&W boilers has always been more than ample—as proved by long-term central station operation at boiler design pressures as high as 2650 psi. Many years of experience stand behind B&W's Divided-Furnace construction with all types of large units—Radiant, Stirling, and Open-Pass. Over 75 B&W Divided-Furnace Boilers are in operation—many for over 10 years—and more than 80 units are under construction, for the following electric utilities:

Alabama Power Company • Appalachian Electric Power Company • Arkansas Power & Light Company • Cincinnati Gas & Electric Company • City of Los Angeles • Cleveland Electric Illuminating Company • Commonwealth Edison Company • Consolidated Edison Company of N. Y. Inc. • Consolidated Gas, Electric Light & Power Company of Baltimore • Dallas Power & Light Company • Detroit Edison Company • Duquesne Light Company • Electricite France • Georgia Power Company • Houston Lighting & Power Company • Indiana & Michigan Electric Company • Jersey Central Power & Light Company • Kentucky Utilities Company • Long Island Lighting Company • Middle South Utilities, Inc. • Monongahela Power Company • Niagara-Mohawk Power Corp. • Northern Indiana Public Service Company • Ohio Edison Company • Ohio Power Company • Pacific Gas & Electric Company • Pennsylvania Electric Company • Philadelphia Electric Company • Public Service Company of Colorado • Public Service Company of Northern Illinois • Public Service Company of Indiana Inc. • Public Service Company of Oklahoma • Public Service Electric & Gas Company • Southern California Edison Company • Tennessee Valley Authority • Texas Electric Service Company • Texas Power & Light Company • Toledo Edison Corp. • Union Electric Company • West Penn Power Company • Wisconsin Power & Light Company



EFFECT OF DIVISION WALLS ON BOILER WIDTH—KEEPING HEIGHT CONSTANT



EFFECT OF DIVISION WALLS ON BOILER HEIGHT—KEEPING WIDTH CONSTANT

FURNACE

Division wall furnace construction is used in combination with other significant achievements of B&W Research and Development, including the Cyclone Furnace, Pressure-Firing, Gas Recirculation, and improved alloys for high steam temperatures. Widely accepted throughout the power industry, these modern B&W advances are making major contributions to more economical and reliable steam generation.

B&W's continuing program of progressive research combined with its broad experience in designing and building boilers with the highest capacities in existing pressure-temperature ranges, assure you of the most efficient and economical solutions to your specific steam generation problems.

ADVANTAGES OF DIVIDED FURNACE CONSTRUCTION

- Provides greater cooling area without increasing furnace volume
- Reduces steel and other material costs by keeping boiler and building volume to a minimum
- Lowers furnace construction costs
- Cuts operating costs by reducing slagging in furnace and in convection surface

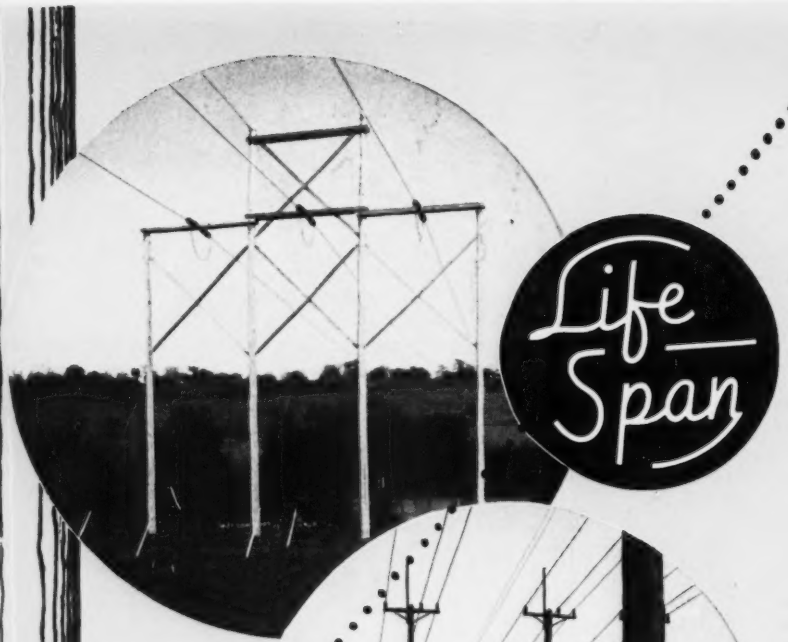
Triple furnace boilers for 1 boiler—1 turbine units of over 200,000 KW capacity are now being constructed

BABCOCK & WILCOX

G-569T

LIFE SPAN *Cedar*

THE POLES THAT REFUSE TO GROW OLD



Life Span

Life Span

After 11 years of continual high-tension-line service, LIFE-SPAN treated Cedar poles are as perfect as they were at the time of installation. They still are 100% protected against deterioration and still retain 100% of the LIFE-SPAN preservative. Service life-expectancy is still ahead for all LIFE-SPAN poles.

A remarkable record which we at Consolidated Treating Co. are proud to report! We are still searching for the *first* LIFE-SPAN pole to show decay, or signs of any deterioration after 11 years of line service. Our chemists are continually making repeat tests on LIFE-SPAN installations in many parts of the country. To date, every pole tested shows true soundness, with years of line service still ahead.

Once the LIFE-SPAN pole treatment is applied, Western Red Cedar poles simply cannot decay!

CONSOLIDATED TREATING CO.
MINNEAPOLIS, MINNESOTA

Sold only by the following:

PAGE & HILL, INC.
Minneapolis, Minnesota
50 Church Street, New York, N. Y.

B. J. CARNEY & CO.
Spokane—Minneapolis

SCHAEFER-HITCHCOCK CO.
Sandpoint, Idaho
Suppliers for Joslyn Mfg. & Supply Co.

NAUGLE POLE & TIE CORP.
Chicago, Illinois

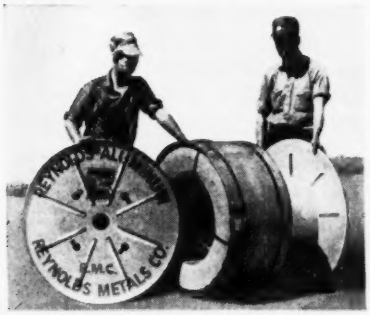
(*Advertisement*)

Electrical Applications of Aluminum

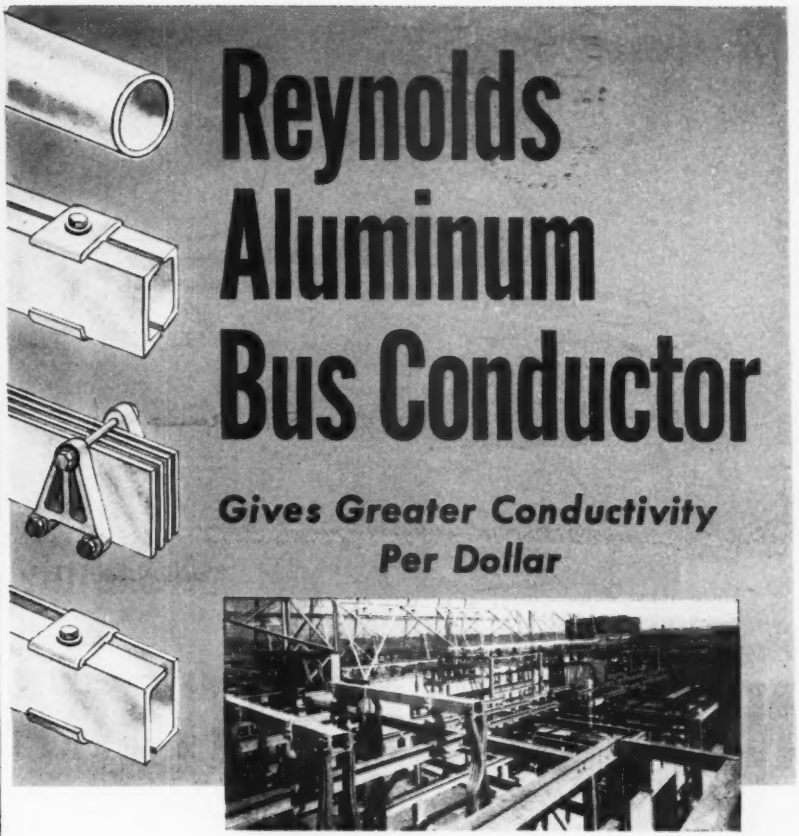
Aluminum Cable Steel Reinforced

Worthwhile savings are yours with Reynolds ACSR because the initial price of this steel reinforced aluminum cable is less, and because you save through reduced handling and field costs. Men and equipment handle 20% less weight so stringing is easier and faster. Reynolds ACSR is light yet strong—you can go to longer distances between poles—save up to four poles per mile. Or, because there is less sag, you can use shorter poles or towers. Write for the free ACSR manual on line design and erection...sag-tension charts, staking tables, stringing-sag tables, etc. Please request on your business letterhead.

Master Reel and Coil Service



Reynolds offers a Master Reel and Coil Service that goes hand-in-hand with Reynolds ACSR toward saving time, money and labor. An all metal Master Reel sharply decreases handling, storage and bookkeeping costs. Four Master Reels take the place of 100 wooden reels. They're easily taken apart and re-assembled around the Master Coil by linemen in the field. Reynolds Master Coils hold the same amount of conductor as conventional wooden reels. They're carefully waterproofed, lagged and banded for complete protection in transit and on the job. For further details, write to the Reynolds Metals Company or see one of these Reynolds distributors: A. A. Electric Supply, Chicago • California Electric Supply, San Francisco • General Electric Supply Co., Bridgeport (and branches) • Hendrie & Bolthoff, Denver • Hughes Electric Supply, Orlando • Maydwell & Hartzell, Inc., San Francisco • San Antonio Machine & Supply Co., San Antonio • Southern Electric Equipment Co., Atlanta • Chas. L. Ward Co., Kansas City, Mo. • Westinghouse Electric Supply Co., New York City (and branches) • Williamson Sales Co., Shreveport.



Reynolds Aluminum Bus Conductor

Gives Greater Conductivity Per Dollar

6 inch square extruded aluminum tubing used for 13 kv, 4,000 ampere conductor in generating station.

Bus conductor made of Reynolds Aluminum costs less than conductor made of other metals—gives you *more* conductivity per dollar. Aluminum bus conductor assures other economies, too, because its lighter weight permits greater span lengths, reduces floor loads, allows faster, easier handling and saves on erection time and labor costs.

Aluminum bus conductor in form of rectangular bars, channels, angles, special extruded shapes and tubing is finding widespread application in utility generating plants and substations, in industrial installations and packaged power control and distribution units. For most uses, past technical problems have all been solved. So, before you plan your next job, consider these characteristics of aluminum: lower cost, high electrical conductivity, light weight with high strength, excellent resistance to corrosion, ease of fabrication, plus other factors favorable to individual applications.

Sooner or later you'll use aluminum—why not now? Start by sending for a copy of AIEE conference paper, Drawn and Extruded Aluminum Products in Relation to the Electrical Industry. For design assistance on your specific applications call on Reynolds Aluminum technical specialists. *Reynolds Metals Company, 2584 South Third Street, Louisville 1, Kentucky.*

Remember—Reynolds technical assistance is always available

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

IH scores again...

NEW INTERNATIONAL TRUCKS

Proved as only IH can prove 'em

The 307 new features in the *New* International Trucks have been . . .

Proved in the world's most advanced truck Engineering Laboratory at Fort Wayne, Ind., **Proved again** on International Harvester's 4000-acre Arizona desert Proving Ground.

For profit-minded buyers. *New* International Trucks offer an unmatched combination of values—exactly the right truck for the job, unequalled performance, lowest maintenance and operating costs, maximum driver comfort.

Built the IH way. Choose from 168 basic models in America's most complete truck line. Each model embodies engineering principles, used in International's continuing program of truck research and development, that have resulted in hundreds of exclusive International features which have meant greater profits for truck buyers.

New International Trucks are BUILT as only IH can build them, PROVED as only IH can prove them, a VALUE only IH can give you.

Now—the features you want—in America's most complete truck line

New International styling identified by the IH emblem . . . **Exactly the right power** for every job. First truck builder to offer choice of gasoline or LP gas with Underwriters' Laboratories listing in 1½-ton sizes and other models . . . **Diesel power** optional in models rated 22,000 lbs. and over . . . **Designed by drivers for drivers**—Comfo-Vision cab with one-piece Sweepsight windshield. New comfort and interior styling . . . **Steel-flex frames** proved best in the field . . . **Transmissions** to meet any operating requirement . . . **296 Wheelbases** ranging from 102 inches up . . . **Easy starting and greater fuel economy . . . Wide range** of axle ratios for all models . . . **Real steering comfort and control.** Sizes from ½-ton to 90,000 lbs., GVW rating. Now—See The New IH-Built, IH-Proved Internationals at your nearest International Dealer or Branch

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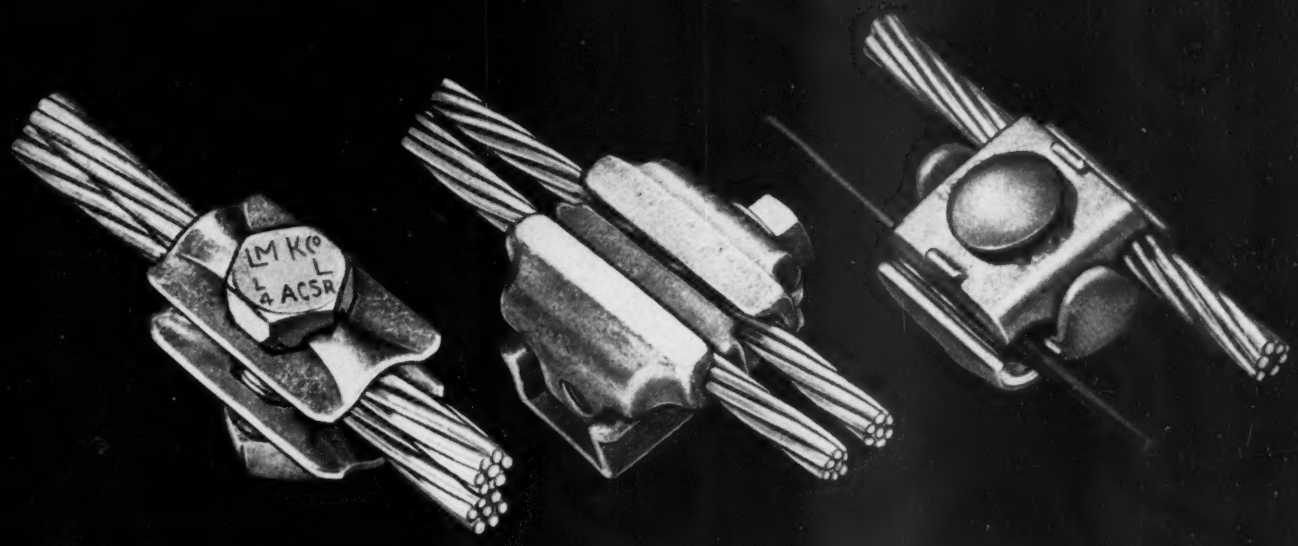
International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

Better roads mean a better America

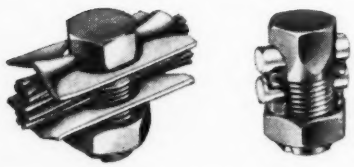
INTERNATIONAL TRUCKS

"Standard of the Highway"

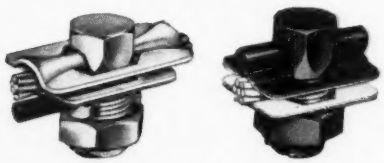


ONLY L-M Offers All 3 Types of Connectors for Aluminum

1—SPLIT BOLT



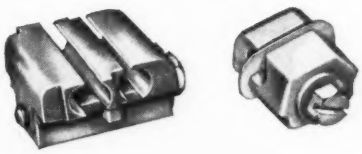
For Al to Al: Type AA, left, is plated bronze with two aluminum washers. For #2 to 4/0 solid; #4 to 4/0 ACSR. Type PB, right, is a plated bronze connector with plated spacer bar. Sizes from #2 to 4/0 solid aluminum; #4 to 4/0 ACSR.



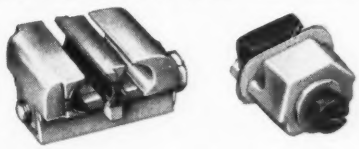
For Al to Cu: Type AC, left, is plated bronze with one aluminum and one bimetal washer. Five sizes, for #2 and 1 solid, #4 to 4/0 ACSR, and #2 to 4/0 solid copper or #3 to 4/0 stranded copper. Type CA, right, has a bronze body with two bimetal washers. In a full range of sizes from #6 solid aluminum to #4/0 ACSR, and #6 solid copper to #4/0 solid or stranded.

L-M Split Bolt and Fargo Vise-Type Connectors fully meet new standards of the Electrical Service Connector Institute.

2—VISE TYPE

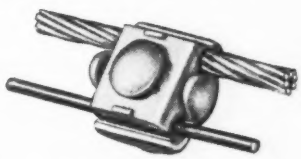


For Al to Al: The famous Fargo vise-type connectors provide wide contact surfaces and massive design for greater heat dissipation; always threaded; no loose parts. At left, No. 9000-3, for sizes up to and including 397,500 Al; No. 9000-1, right, for #4 ACSR and smaller.

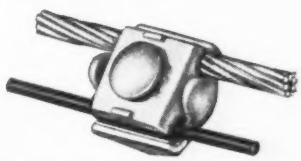


For Al to Cu: The vise-type principle in cast alloy with bimetal inserts, for aluminum to copper connections. No. 9000-4 at left is for sizes up to and including 397,500 Al. No. 9000-2 at right is for #4 ACSR and smaller.

3—CLAMP TYPE



For Al to Al: One-Bolt Parallel Groove Clamp, No. CL10X, for Al to Al connections. Clamp casting is aluminum, with galvanized steel square shank bolt, washer, and nut. For ACSR #6 to 4/0, #4 to 1/0 armored.



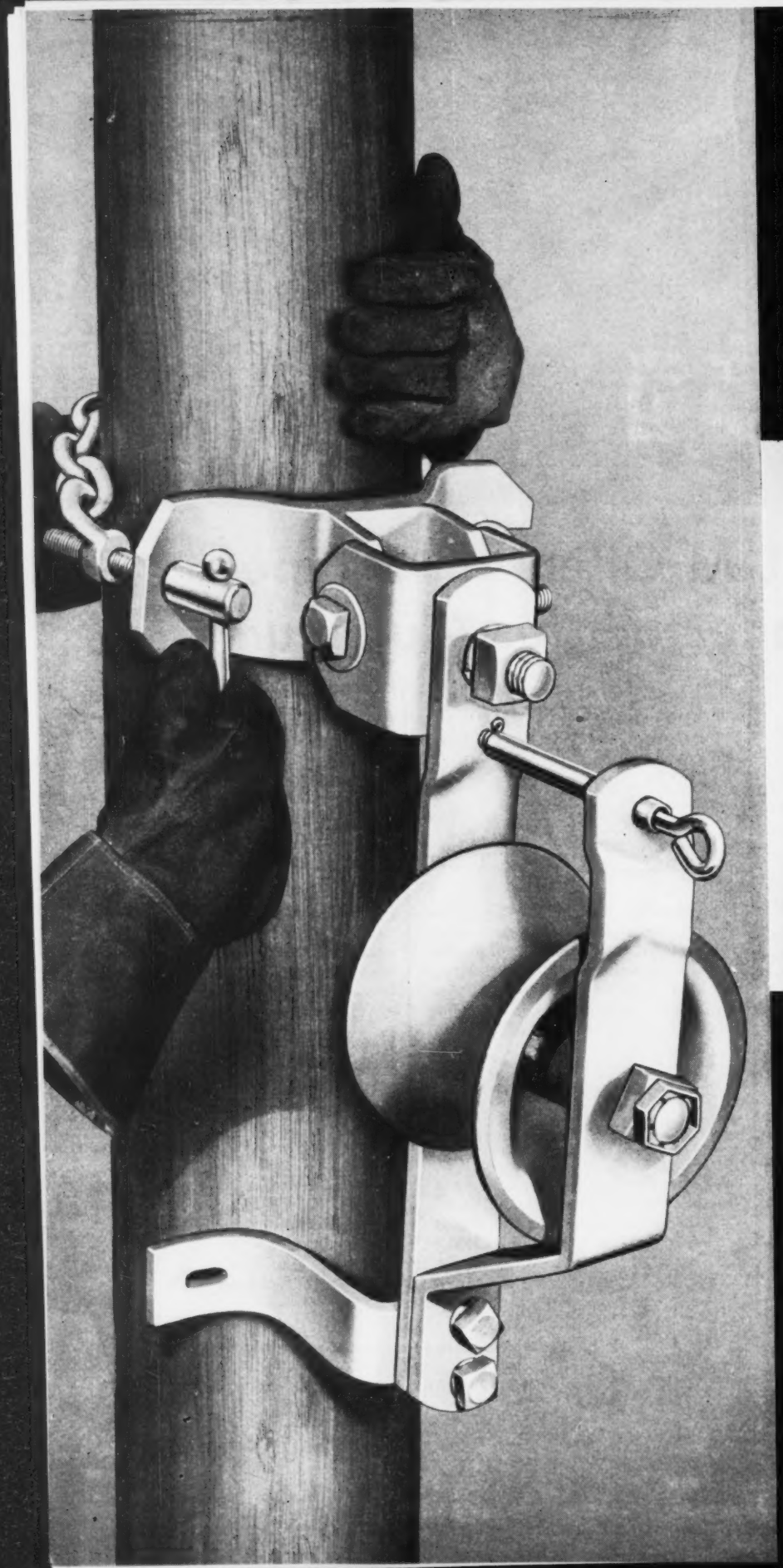
For Al to Cu: One-Bolt Parallel Groove Clamp, No. CL10X, same as above, except that copper liners are brazed to aluminum body on tap side. For copper taps #12 to 2/0. Also in all bronze for copper-to-copper connections.

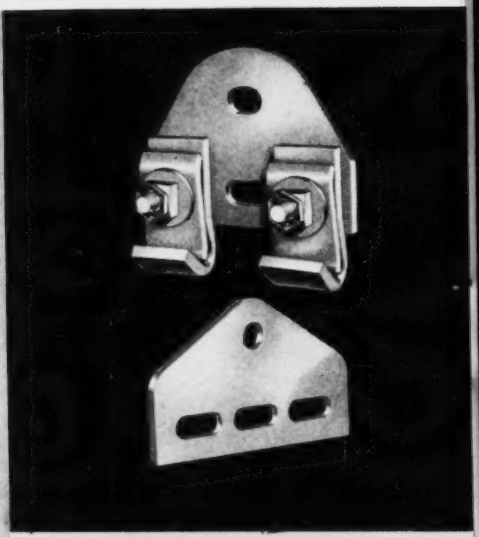
Ask L-M's Connector Headquarters for Information

Years of research and development by L-M Engineers assure the best connectors and a full range of types for aluminum, copper, and combinations. See the L-M Field Engineer or write for bulletin. Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

LINE MATERIAL Connectors

Complete Coordinated Equipment for Distribution Today

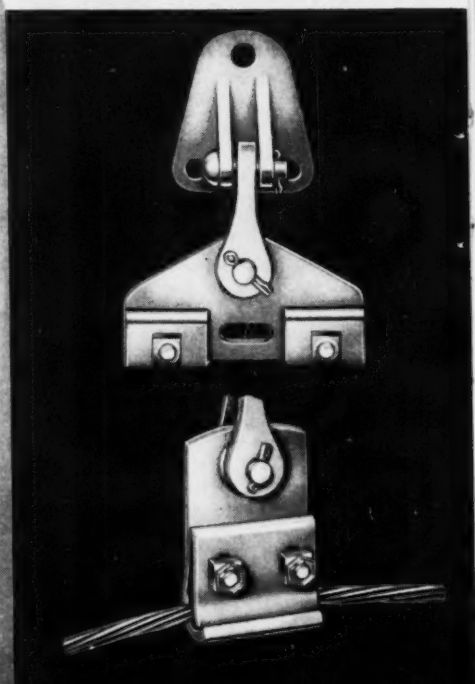


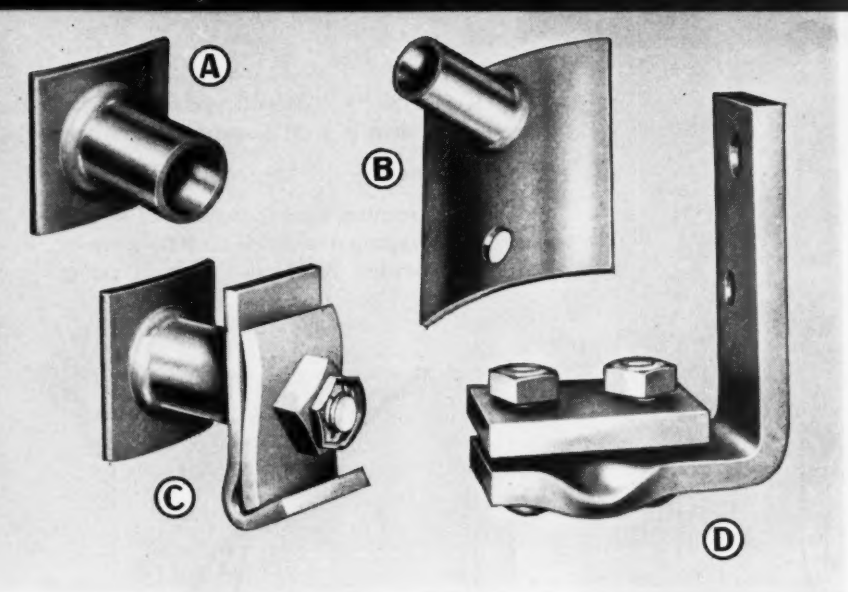


DOUBLE SUSPENSION HANGER clamps the messenger and may be used during stringing without tightening the clamps. The lower plate takes two or three one-bolt clamps. May be mounted as a unit with a machine bolt and washer spacer, or hung on the swinging bracket.

HINGED STRINGING PULLEY needed at each pole for economical, safe installation of aerial cable without damage to conductor insulation. Used on both tangents and angles, mounted just below the permanent messenger clamps, and removed after line is strung. Hinged joint between pulley yoke and pole frame permits pulley to swing out, keeping cable in the groove.

DOUBLE-SWING SUSPENSION BRACKETS made by combining standard parts. Below is the complete bracket; bottom illustration shows another type of hanger that may be substituted. Meets unusually severe conditions, where a free-floating bracket is needed. Assists in equalizing stresses on cable. Malleable pole plate is curved, to give extra rigid support; mounted with one machine bolt and two lag screws.

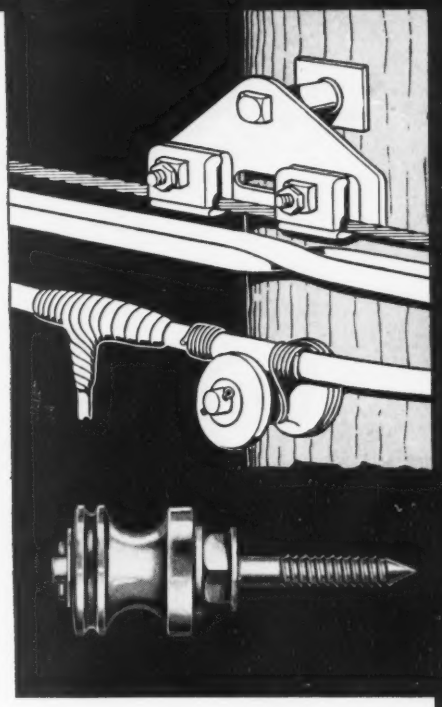




WASHER SPACERS used where standard machine bolts are used to mount messenger clamps. These spacers provide good bearing on the pole and keep cable from rubbing against the wood. Top left (A) is Flat Washer Spacer; at right (B) is Curved Plate Spacer for heavier cables, or longer spans; lag screw in lower hole keeps machine bolt from ovalizing hole in pole.

ONE-BOLT HANGER (C) shown with small washer spacer, used for small aerial cables such as street lighting and secondary cable. Rounded groove, flared edge. For ½" or ⅜" bolt.

UNIVERSAL MESSENGER HANGER (D) used for smaller size cable or where minimum clearance between cable and pole is required. Rounded groove has widely flared edges to prevent nicking the strand as well as to permit using this hanger on small angles as well as tangents. Forged open-hearth steel, hot-dip galvanized. Widths from pole 3⅞" and 4 3/16", and 4⅞" high, with offset holes for ⅝" machine bolt and ½" lag screw. Two ½" track bolts. For messenger from ¼" to 9/16".



INSULATED LAG SCREW BRACKET used to support the phase conductor where the conductor has been taken out of assembly—for example, when making a transformer tap. Standard ½" x 3" gimlet lag screw, with head and extension for a 3" dry or wet process spool insulator.

L-M Offers Service-Tested Materials to Simplify Aerial Cable Construction

DOUBLE UPSET EXTENSION BOLT provides, in one piece, a mounting bolt, spacer for pole clearance, and extension for mounting clamps. Eliminates stocking and assembly of separate parts, and thus saves more in time than it costs. Strong hexagonal section provides wrench hold. One-piece mild steel forging, ⅝" diameter, 6 to 18" long plus 4-inch extension.

To meet the special requirements of aerial power cable, Line Material some years ago began to study the needs for construction materials. The engineers, working alongside of the utility company specialists, soon found that standard pole line hardware was seldom completely satisfactory. And so a program of designing and testing special hardware was instituted. This program has continued, and as new requirements appear, new items are developed and tested.

L-M aerial cable construction materials are designed for maximum utility and interchangeability. These items can be fitted together in a variety of combinations to serve a number of purposes. The result is that with L-M aerial cable construction materials, you can solve almost any construction problem, regular or special, that may be encountered.

For help on any problem

Ask the L-M Field Engineer for information on the complete line of L-M aerial cable hardware, and a copy of Bulletin AC1; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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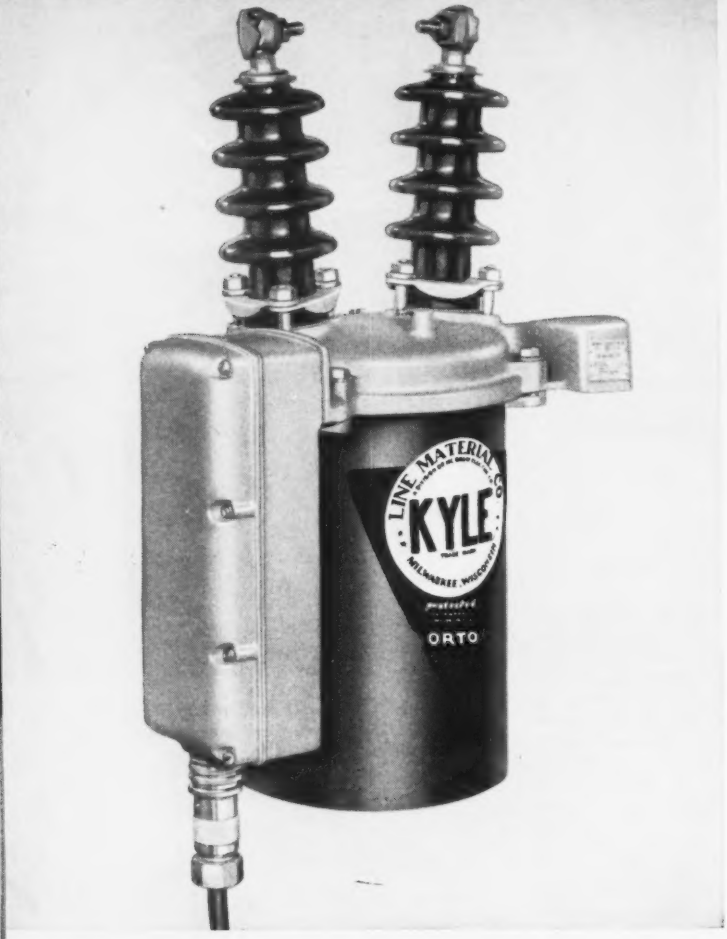
LINE MATERIAL

Line Construction Materials

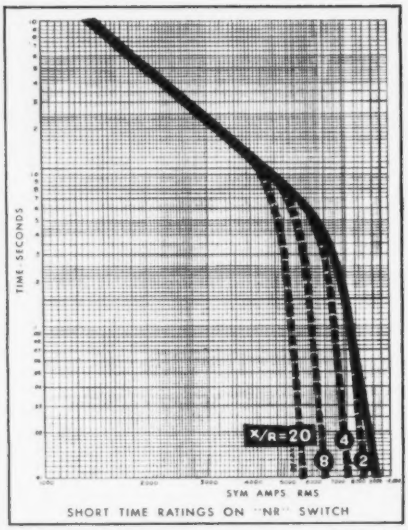
Complete Coordinated Equipment for Distribution Today



L-M's Kyle Type "NR" remote control oil switch—the same switch used in L-M's switched capacitor racks.

"Field-Designed"—with the features users asked for.

200-amperes nominal load rating at 14.4 kv, 150 amperes for capacitor switching. 9000 amperes RMS asymmetrical momentary current rating.



Data 235A

L-M's "NR" Remote Control Oil Switch Provides Low Cost Capacitor Switching

Here is L-M's new motor-operated 200-ampere remote control oil switch. It is specially designed for low-cost capacitor switching up to 3500 kvar 3-phase, but is equally suitable for street lighting, flood and airport lighting, protective lighting, sectionalizing, and other remote control switching applications. Ratings meet users' needs and requirements for capacitor switching and many other applications.

The contact structure is so designed that heavy currents increase contact pressure and give the switch high momentary and short-time current ratings. Spring-loaded contacts give very fast "make" and "break"—which eliminates restrikes and minimizes contact erosion when closing in on large capacitor banks.

The switch can be bolted directly to the pole, or crossarm with a thru-bolt or crossarm-mounted with a clamp-around hanger. Clips also available for mounting on substation steel structure.

Control motor requires less than one ampere at 120 volts, which permits the lightest wiring, simpler control circuit, and gives longer life for limit switches and relays.

Get Full Information

Ask the L-M Field Engineer for details on this new Type NR Switch—or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

Type "NR" Switch Ratings

SINGLE PHASE

VOLTAGE

Nominal	RMS 14.4 kv
Maximum design	RMS 15.0 kv
60 cycle, one minute withstand, dry	RMS 35.0 kv
60 cycle, ten-second withstand, wet	RMS 30.0 kv
1½ x 40 Ms impulse withstand, crest, BIL	95.0 kv

CURRENT

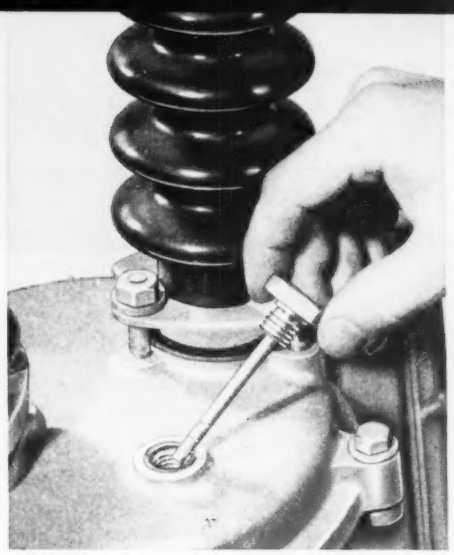
Thermal	200 amperes
Capacitor switching, nominal	150 amperes
Inductive load switching,	
75 to 100% PF	200 amperes
50 to 75% PF	100 amperes
Less than 50% PF	50 amperes
Momentary, RMS Asymmetrical	9000 amperes
Short-time, RMS Symmetrical	
10 seconds	1400 amperes
1 second	4500 amperes

For larger ratings at shorter time intervals see curve, Data 235-A above.

CONTROL

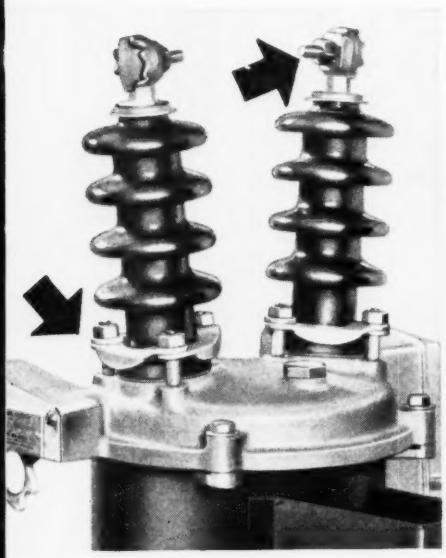
Motor-operated actuator requires less than one ampere at 120 volts. Permits simplest control circuit and gives long life of limit switches and control relays.

Head may be rotated and set at desired position. Lips in the groove on the underside of head hold the gasket so that it doesn't fall out when the cover is lifted.

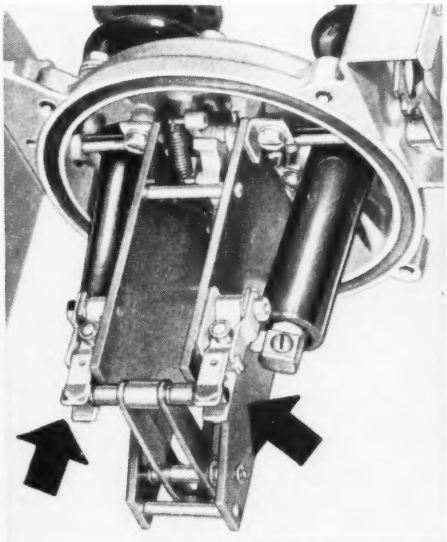


Oil dip stick on the head for checking the oil level. The tank holds 1½ gallons of oil. The inner mechanism is insulated from the tank by the oil and by a tank liner.

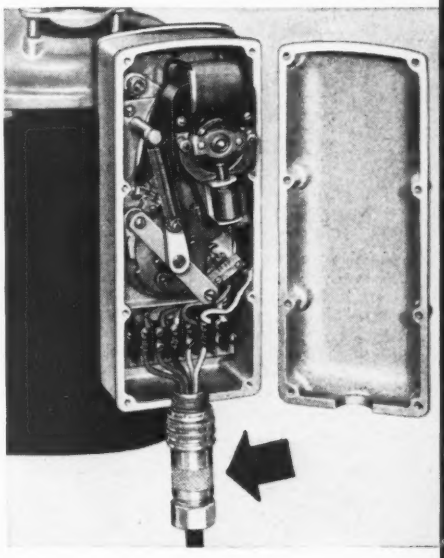
Heavy bracket for direct mounting to pole or crossarm with or without a hanger. Heavy tank, with inserted concave bottom, so that only the rim takes abrasion.



The bushings are the clamp-on type which make replacement easy. Bushings are oil-filled for lowest radio noise level. Plated Universal terminals for aluminum or copper conductor, No. 8 to 2/0.



Contacts arranged so heavy currents increase contact pressure, giving high momentary and short time current ratings. Spring-loaded contacts give quick make and break to prevent restrikes and minimize erosion.



Motor-operated actuator requires less than one ampere at 120 volts, permitting lighter wiring and simplest control circuit, and assuring long life for limit switches and relays. Weatherproof plug-in connection at bottom of box and weatherproof plug available.

CAPACITOR SWITCHING RATING

Voltage	Based on 25 KVAR Units				Based on 15 KVAR Units			
	Three-Phase		Single-Phase		Three-Phase		Single-Phase	
	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units	Bank Size KVAR	No. of Units
2400	600	24	350	14	585	39	360	24
4160	1050	42	625	25	1080	72	615	41
4800	1200	48	725	29	1215	81	720	48
7200	1800	72	1075	43	1845	123	1080	72
12470	3225	129	1850	74	3240	216	1860	124
13200	3375	135	1975	79	3420	228	1980	132
13800	3525	141	2050	82	3555	237	2070	138

LINE MATERIAL

Kyle® Oil Switches

Like all Kyle reclosers, the Type NR switch is filled with ORTO®, L-M's oxidation-resistant transformer oil, inhibited for longer life.

98R

Dependable

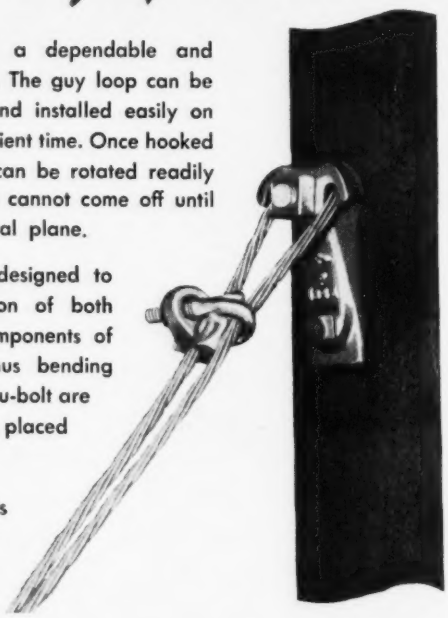
M|F GUY HOOKS

Never let a guy down!

Loop securely retained.

Guy at any angle up to 90° with pole.

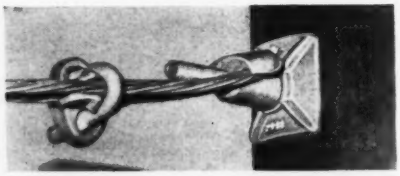
- **M.I.F. Guy Hooks** are a dependable and economical guy attachment. The guy loop can be made up on the ground and installed easily on the Guy Hook at any convenient time. Once hooked over one of the "ears", it can be rotated readily into its proper position and cannot come off until again turned to a horizontal plane.
- **M.I.F. Guy Hooks** are designed to transmit a large proportion of both vertical and horizontal components of the load to the pole. Thus bending and shear stresses on the thru-bolt are minimized and the bolt is placed chiefly in tension.
- **Each M.I.F. Guy Hook** is a single malleable iron casting, hot dip galvanized.



Wedge resists vertical movement; permits higher initial tension on thru-bolt.

Spurs add to vertical stability.

Light duty Guy Hook for down, span and arm guys. Also a House Bracket. Reduces inventory.



P137 Series for dead ending arm and head guys, and messengers, at any angle to 30° with the horizontal.

Channel back provides better fit on poles.

Wide heel pad provides maximum resistance to overturning.

SPECIFICATIONS

Cat. No.	Maximum Bolt Dia.	Maximum Strand Dia.	Thimble Dia.	Approx. Shipping Wt. Lbs./C.
Guy Hooks				
PX85	⅝″	⅜″	1⅜″	45
P135A	⅝″	7/16″	1⅞″	110
P133A	¾″	½″	1⅝″	136
P132C	¾″	¾″	2⅜″	275
P132B	1″	¾″	2⅜″	275
Span Guy Hooks				
P137	① ⅝″	½″	1⅝″	69
P137A	② ⅝″	½″	1⅝″	70
P137B	② ¾″	½″	1⅝″	68
P137C	① ¾″	½″	1⅝″	67

① Clearance hole. ② Tapped hole.

MALLEABLE IRON FITTINGS CO.

Pole Hardware Division **Branford, Connecticut**

N. Y. Office: 30 Church St. • Canadian Mfr. & Dist.: Line & Cable Accessories, Ltd. Toronto

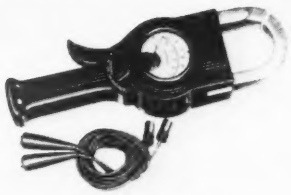
Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill. • B. H. McCoin, Knoxville, Tenn. • E. A. Thornwell, Inc., Atlanta, Georgia • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Krusi, San Francisco, Calif. • L. G. Wendegatz, Kansas City, Mo. • Williams Sales Co., Fort Myers, Fla. • Williamson Sales Co., Shreveport, La. • O. C. Witte Co., Detroit, Mich.

Model 622—Ultra-Sensitive Instruments

Portable d-c and a-c thermo instruments for precision measurement of potentials and minute currents in electronics or laboratory research.

Model 901
Portable Test Instruments

Available in d-c, Model 901—and a-c, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.



A-C Clamp Volt-Ammeter

(Model 633, Type VA-1) For convenient and rapid measurement of a-c voltage and current without breaking the circuit. Jaws take insulated or non-insulated conductors up to 2" diameter. Safe, rugged, versatile. Also available as a-c clamp ammeter, without voltage ranges.

Specialized and Multi-purpose INSTRUMENTS

for

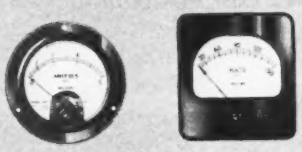
- **RESEARCH**
- **PRODUCTION**
- **MAINTENANCE**

For complex, or just routine measurement jobs, these and other specialized WESTON Instruments save time and assure dependable measurements. For information on the complete line, see your local Weston representative, or write . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

WESTON
Instruments

Sensitive Relays

A line of sensitive relays including the Model 705 which provides positive operation at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

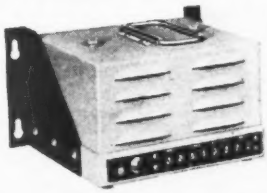


Panel and Switchboard Instruments

A complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including d-c, a-c power frequencies and radio frequency, rectifier types and D.B. meters.

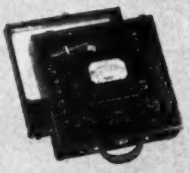
Model 697 Volt-Ohm-Milliammeter

One of a line of pocket-size meters, Model 697 combines a selection of a-c and d-c current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.



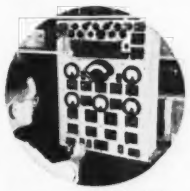
Model 1411 Inductronic D-C Amplifier

Stable amplifier provides high degree of resolution even at fractional loads. Reaches steady full scale deflection in a fraction of a second. Interchangeable plug-in range standards for either microamperes or millivolts.



Industrial Circuit Tester—Model 785

A multi-range, multi-purpose, ultra-sensitive analyzer, for laboratory and industrial checking of electrical and electronic circuits. Has 28 practical scale ranges; measures d-c and a-c voltage, d-c and a-c current, and resistance. Accessories available to extend ranges. Compact and portable; furnished in either oak or steel case.



Model 686
Electronic Tube Analyzer

Tests tubes under exact operating potentials. Accurately determines true mutual conductance of all tubes, in accordance with manufacturers' rated operating conditions, or under special operating conditions.

High Frequency Electronic Analyzer
Model 769

A three-in-one instrument providing a self-contained Volt-Ohm-Milliammeter, a high impedance electronic D-C Volt-Ohmmeter, and a probe type Vacuum Tube Voltmeter for use to 300 megacycles. Exceptionally stable and accurate. Has specially designed extremely small RF and D-C probes.

COPE Cable Trough is Used by Utilities and Industrial Plants Throughout the World

The ease and economy of installing standard COPE Cable Trough has given it wide acceptance among the leading utilities and industrial plants around the globe. They realize, as will you, how COPE Cable Trough saves on time, material and costs.

Write for full information.

COPE Cable Trough Installation at Gary Sheet & Tin Mill—U. S. Steel Company

A few of the Users of COPE CABLE TROUGH . . .

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Carolina Power & Light Co.
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Cincinnati Gas & Electric Co.
Cleveland Electric Illuminating Co.
Commonwealth Edison Co.
Connecticut Light & Power Co.
Consolidated Gas, Electric Light & Power Co. of Baltimore
Delaware Power & Light Co.
Detroit Edison Co.
Detroit Steel Corp.
Dow Chemical Co.
E. I. du Pont de Nemours & Co., Inc.
Ethyl Corporation
Ford Motor Company
Goodyear Tire & Rubber Co.
Indianapolis Power & Light Co.
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Island of Iceland
Jersey Central Power & Light Co.
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Philadelphia Electric Co.
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Southern California Edison Co.
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United States Army—Corps of Engineers
United States Bureau of Reclamation
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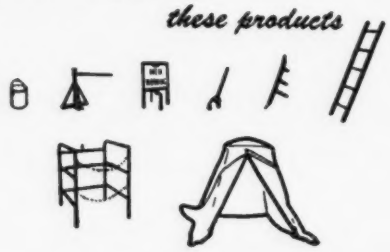
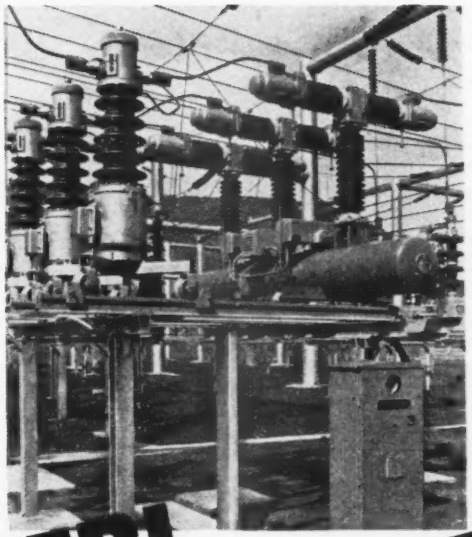
T.J. Cope INC.

T. J. COPE, INC., 711 SOUTH 50th ST.
PHILADELPHIA 43, PENNSYLVANIA

You know Cope by these products



there's more to a BROWN BOVERI AIR BLAST BREAKER than meets the eye...



Built into every Brown Boveri Air Blast Breaker are *plus values* that make these basic factors possible . . .

1—HIGH SPEED
2—POSITIVE INTERRUPTION UNDER ALL CONDITIONS
3—RAPID RECLOSING
4—AMAZINGLY LOW INSTALLATION COST
5—QUICK and EASY INSPECTION
6—MINIMUM MAINTENANCE
7—DEPENDABILITY
8—DELIVERY
9—COMPETITIVE PRICING

For these reasons . . . and many others . . . more and more utilities, cooperatives and industrial organizations are standardizing on BROWN BOVERI outdoor and indoor air blast breakers.

Facts that tell the complete story are yours for the asking. *Write for them today!*

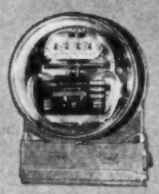
BROWN BOVERI

BROWN BOVERI CORP.
19 RECTOR STREET, NEW YORK 6, N. Y.

Single Phase
Detachable Meters

Single Phase
Bottom-Connected Meters

Polyphase
Detachable Meters



Polyphase
Bottom-Connected Meters

Combination Polyphase
and Thermal Watt
Demand Meters

Polyphase Thermal
KVA Demand Meters

Polyphase
Switchboard Watthour
Meter-Flexitest Case

Polyphase Switchboard
Combination Watthour
and Thermal Watt Demand
Meter-Flexitest Case

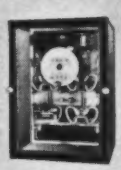
Polyphase
Recording Differential
KW Demand Meters

Polyphase Recording
KVA Demand Meters

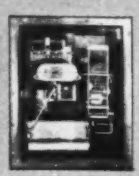
Polyphase
Totalizing Recording
KVA Demand Meters

Polyphase Indicating
KVA Demand Meters

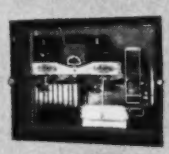
Combination Polyphase
and Thermal KVA
Demand Meters



Polyphase KVA Demand
Impulse Senders



Polyphase Impulse
Operated Recording
KW Demand Meters



Polyphase Impulse
Operated Recording
KVA Demand Meters

Single Phase
Varhour Meters

Block Interval
KW Demand Registers—
Indicating and Cumulative

Phase Shifting
Transformers

Portable Standard
Watthour Meters

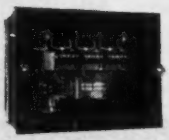
Combination Single Phase and Thermal Watt Demand Meters

There's a Westinghouse meter for every application!

Polyphase Recording Demand Meters

Polyphase Switchboard Totalizing Watthour Meter-Flexitest Case

Single Phase Combination Watthour Meter and Time Switch



Impulse Totalizing Relays

Forecasts of unprecedented load growth in the coming years suggest many changes in metering practices. That's why a *complete* line of metering equipment holds an advantage for you. Specifically . . .

It's assurance that your *future* as well as your present needs can be readily fulfilled.

The wide variety of meters illustrated here is typical of the broad line of Westinghouse Meters offered to you. These and many more types are available to give you low-cost metering for every circuit application . . . three wire, four wire, wye or delta, or totalizing.

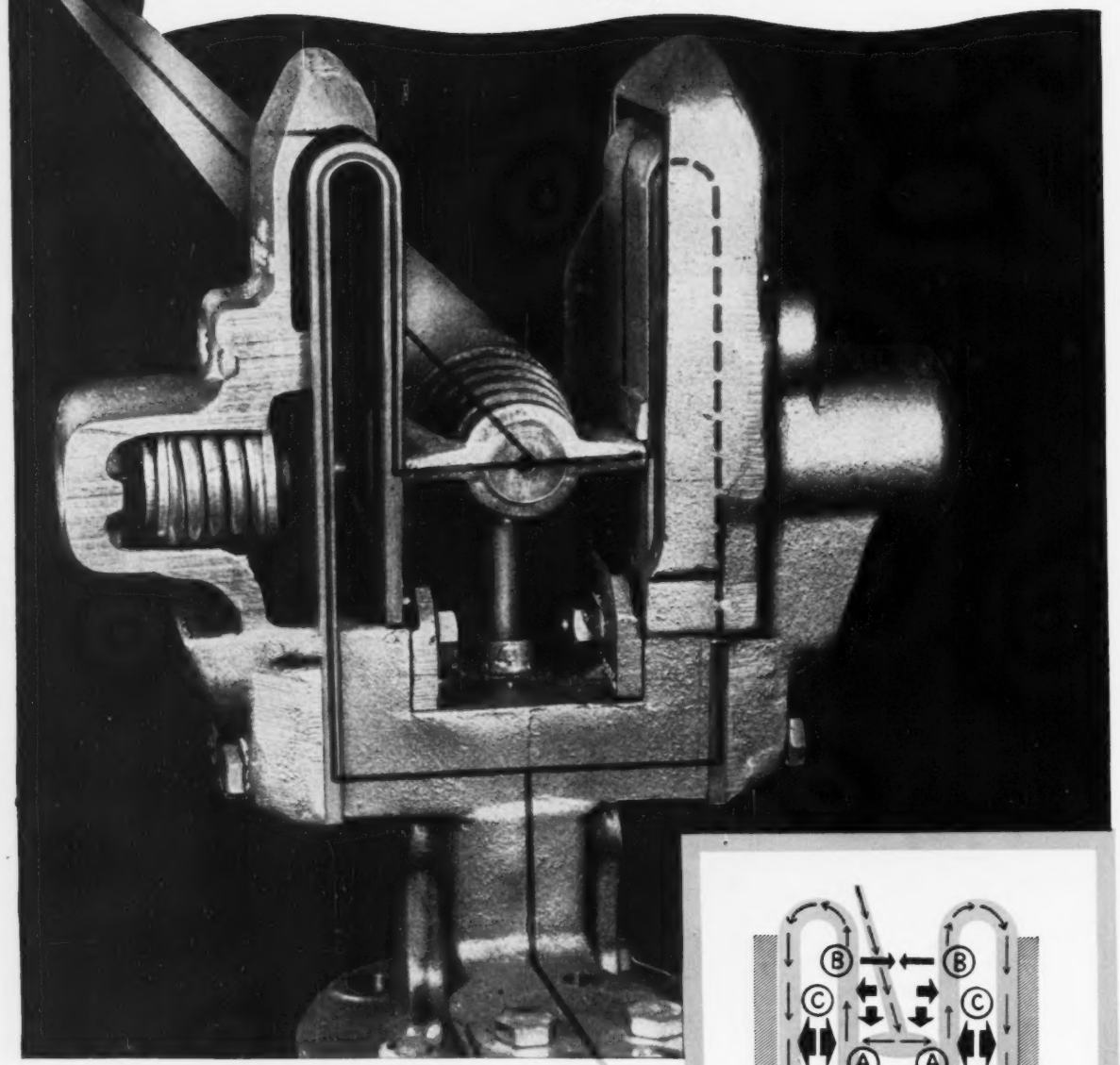
To meet your expanding needs Westinghouse has continually pioneered new devices to make the desirable changes in metering methods a practical reality. And you have assurance of dependability because every Westinghouse Meter contains the quality and refinements that result from the engineering of a complete line. So whether your needs involve metering large loads or small, single or polyphase circuits, kw or kva, Westinghouse can meet your requirements.

For more information write for Booklet B-4665. Call your Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40408

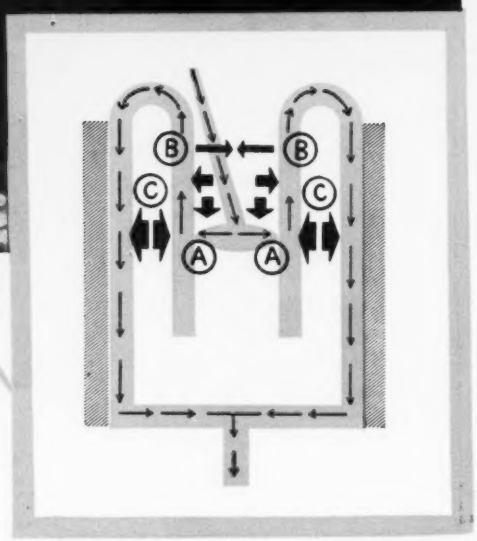
YOU CAN BE SURE.. IF IT'S Westinghouse METERS

AMPLITACT

TRADE MARK



PATENT APPLIED FOR



HERE is a cutaway view of the AMPLITACT with current path shown in orange. Field tests have dramatically proved the effectiveness of this contact.

a revolutionary concept of air break switch contacts

Now for the first time in high pressure air break switch contact construction, the magnetic fields surrounding current carrying members are utilized to effect higher contact pressure. With this design, any increase in current flowing through the contact is reflected in a proportional increase in contact pressure and in forces which hold the blade in the closed position.

What does this mean to switch performance on today's circuits?

It means that a switch equipped with the AMPLITACT can keep pace with increasing system short circuit capacities. When the magnitude of the current increases, the AMPLITACT responds with increased contact pressure assuring maximum dependability of switch performance.

The AMPLITACT is an exclusive Southern States feature.

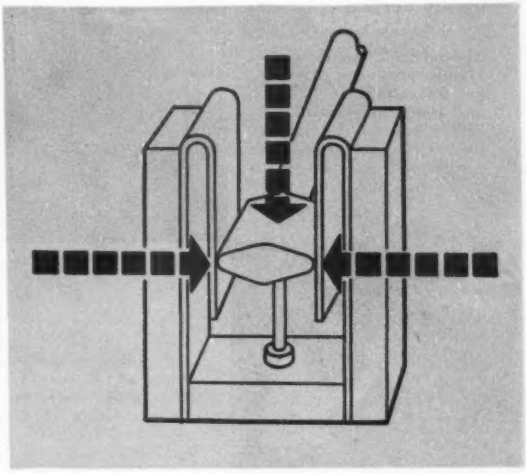
Here is the AMPLITACT . . .

The schematic drawing traces current through the AMPLITACT. Inner segments of loop are resilient and outer segments are fixed against rigid abutments.

A. Current flowing through blade changes direction 90° when current interchange is made at junction of blade tip and resilient contact. Resultant forces from these changes in current direction hold the blade in the closed position.

B. Two parallel paths are formed for the current in the two resilient segments. Since the current is flowing in the same direction, these conductors tend to attract . . . thus increasing contact pressure.

C. Two parallel paths are also formed by the fixed and resilient segments. However, in this case the current is flowing in opposite directions in conductors in close proximity. The result is a powerful force from opposing magnetic fields which amplifies contact pressure in proportion to the square of the current flowing through the loops.

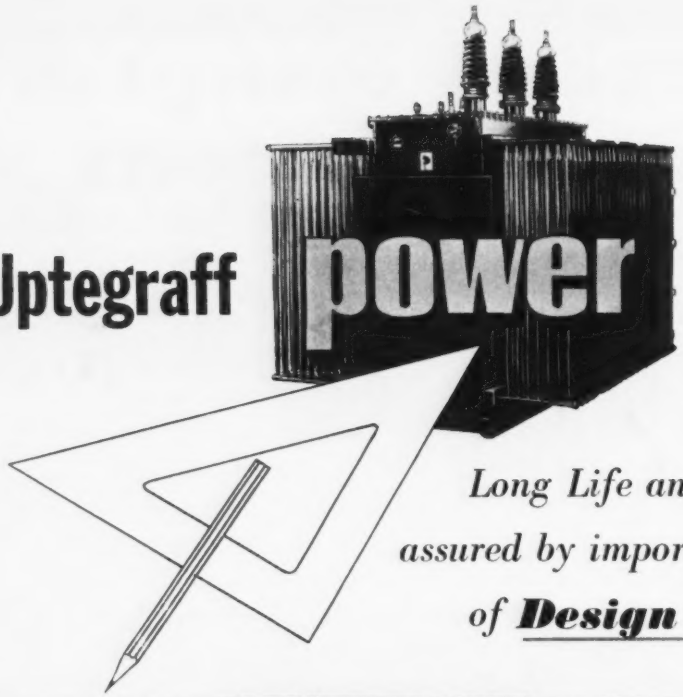


The AMPLITACT design principle is such that resultant electromagnetic forces induced by current flowing through the contacts . . .

1. Greatly increase contact pressure
2. Force the blade firmly in the engaged position.

Southern States Equipment Corp.
HAMPTON, GEORGIA

Uptegraff power Transformers



Long Life and Low Maintenance assured by important features of ***Design and Construction***

RUGGED

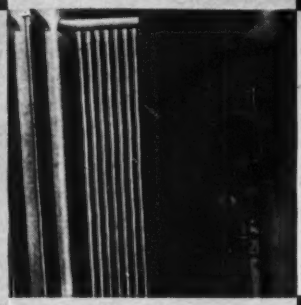
Special tank bracing withstands pressures of ±10 psi for ratings of 44 KV and less, and ±15 psi for higher ratings. Radiators are sturdy, yet accessible for cleaning and painting.

TIGHT

To eliminate leaks in sealed joints, a modern supersensitive electronic leak detector is used. It will find leaks as small as one ounce of air per year!

UNDERCOATED

The under surfaces of all Uptegraff Power Transformers are treated with a heavy coating that protects inaccessible areas against corrosion.

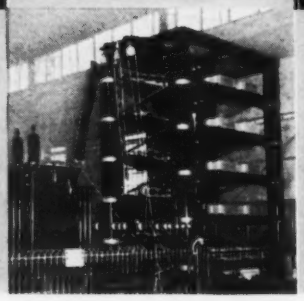


SHOT BLASTED

Tanks are thoroughly cleaned by shot blasting to prepare surface before protective paint coats are applied.

TESTED

Every Uptegraff Power Transformer is thoroughly tested before shipment. Modern test equipment includes a 1.5-million volt surge generator. We are fully qualified and equipped to make all NEMA, AIEE, ASA and other tests up to 10,000 KVA.



ALL SIZES

Made in sizes to 10,000 KVA, 115 KV for indoor or outdoor service. Oil or askarel filled. Uptegraff transformers meet the standards of ASA, NEMA and AIEE, and are *fully guaranteed.*

R. E. Uptegraff Manufacturing Co.

Scottdale, Pa.

F. R. "MAC" McVICKER OF ST. LOUIS welcomes the friendly "SHOW ME" attitude of utility folks he calls upon in Missouri and neighboring states of Indiana, Illinois and Arkansas. "My utility friends always give me a good chance to talk up the many good points of Locke insulators," reports "Mac", "but sooner or later they say 'SHOW ME' proof of what you say. This, of course, gives me a fine opportunity to show some of the wonderful service records established by Locke insulators in this area, as well as in other sections of the country. These service records always impress because they're so outstanding. Service records like these are another one of many good reasons why leading utilities put their confidence in Locke insulators."

In St. Louis, "Mac" McVicker says —

"UNION ELECTRIC COMPANY OF MISSOURI SERVICE RECORDS REVEAL WHY LEADING UTILITIES PUT THEIR CONFIDENCE IN

LOCKE SWITCH INSULATORS"

"After 26 years continuous service in an industrial area, LOCKE SWITCH INSULATORS good enough for re-use on Union Electric 138 KV basic power loop."

reports "Mac" McVicker

"In 1951," says "Mac", "Union Electric tore down a 69 KV sub-station at Cahokia, Missouri, a congested industrial area.

"This sub-station had been built in 1926 using some 265 Locke Switch Insulators. Union Electric intended to junk all unusable equipment, since a new 138 KV sub-station was to be erected on the site. However, engineers noted that even after 26 years of continuous, uninterrupted service, the 265 Locke Switch Insulators appeared to be in excellent condition. These insulators were cleaned, high-potted and power-factor tested and the major portion of them are now being used on the new Clark 138 KV sub-station. The remainder were used in the construction of 138 KV arrester bases and for building 138 KV switches for other parts of the Union Electric system. Certainly," says "Mac", "here's another good example why leading utilities place their confidence in Locke Switch Insulators."

On next page "Mac" McVicker tells why Locke Switch Insulators often give you more than your money's worth.... →

"Mac" McVicker tells why **Locke Switch Insulators** survive and prosper in industrial area served by Union Electric Company of Missouri—

1. "Most important," says "Mac", "is protection of metal parts. Locke Permazinc galvanizing . . . a quality-controlled, double hot-dip method . . . assures the high degree of resistance required to survive industrial atmospheres.

2. "Note the uniformly smooth glazed surfaces which assure easy natural cleaning by wind and rain, and aid the insulator in maintaining its original excellent electrical characteristics."

3. "The Locke wet-process porcelain body . . . the toughest known by Locke . . . has been a standard of comparison since 1893," explains "Mac". "For this reason, Locke Switch Insulators easily survive power arcs, lightning flashovers, and rough handling."

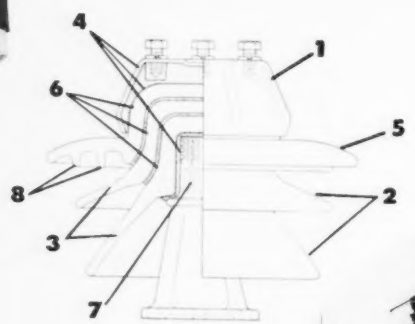
4. "Mac" points out that "the non-hardening, resilient coatings, applied to all unsanded, load-carrying surfaces, distribute loading efficiently and act as expansion joints under temperature changes. This contributes to longer life.

5. "Compression glaze . . . a Locke development . . . increases impact strength and eliminates craze to assure lasting smooth surfaces for easy natural cleaning."

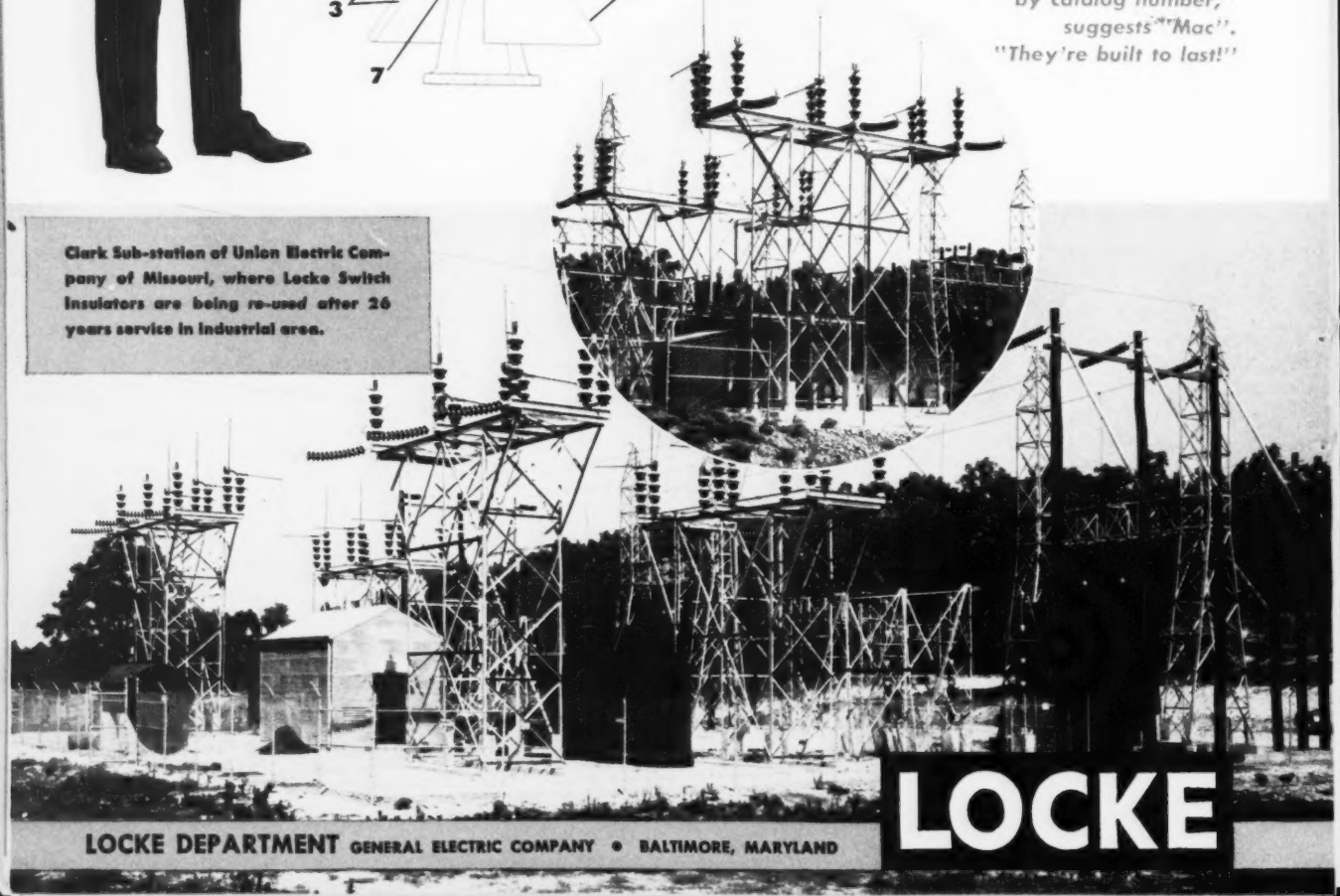
6. "Locke compression sand at the cement joints integrates the multiple shells into a permanent, high strength unit. No loose joints . . . no cracked shells," explains "Mac".

7. "The feature of vertical ribs on the inside of the caps and the outside of the pins provides high torsional strengths," adds "Mac".

8. "The contours of the corrugations," says "Mac", "have been developed to give maximum resistance to mechanical impact. Their depth assures full leakage distance."



"Specify Locke Switch Insulators by catalog number," suggests "Mac". "They're built to last!"



Clark Sub-station of Union Electric Company of Missouri, where Locke Switch Insulators are being re-used after 26 years service in industrial area.

LOCKE DEPARTMENT GENERAL ELECTRIC COMPANY • BALTIMORE, MARYLAND

LOCKE

Short cut to loss . . . . . .

8:30 on a hectic night — and bids for the Cohansey Run Bridge had to be in the night's mail. It was after 5 when the estimators finished the roughs — everything was supposed to be automatic from that point on. Miss Exton was at the new electric calculating machine literally steaming along — when suddenly it stopped. Seems it wasn't steam — it was smoke — the machine had shorted through failure of the electrical insulation. Too late to get a serviceman — and it took 'til 4 A.M. to finish the calculations by hand — all because some manufacturer tried to save pennies by using an electrical insulation that cracked.

Electrical equipment is wonderful when it works. But let the insulation short out and failure is complete.

BH "649", pioneer in the field of vinyl-coated fiberglas tubings, provides extra protection for your equipment against costly rejections and failures. It is permanently flexible, and offers high dielectric strength at continuous operating temperatures of 110°C., with "spot" resistance up to 220°C., without regard to aging and abuse.

Made of continuous Fiberglas yarns, coated with a vinyl compound, BH "649" can be twisted and knotted without damage. It withstands "push-back" during installation, without loss of physical or dielectric properties. It will not fail on a bend — even when bent back upon itself. It is absolutely fray and ravel proof. An imposing list of users testifies to its superiority — specific applications cited on request.

BH "649" is one of a family of BH electrical insulations, each designed to meet particular conditions in service. Give us a few facts about your requirements, product, operating temperatures, voltages. We will furnish production samples for testing purposes.

Address Dept. W-2

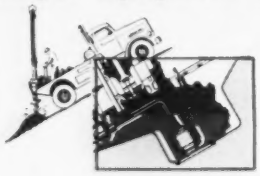
Bentley, Harris Manufacturing Co.
Conshohocken, Pa.

BH *Fiberglas** SLEEVINGS

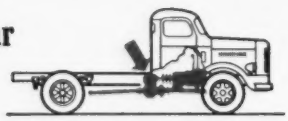
*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

To the job, on the job . . . year 'round FWD's speed work, cut your costs

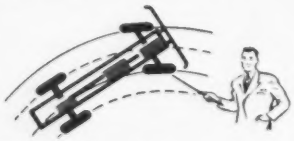
Check all these advantages and you'll see why FWD "Mobilized Tools" alone can offer so much per equipment dollar



High-Climb Oil Sump keeps oil pump constantly submerged. An FWD exclusive that lets you bore holes, set poles on steepest grades or slopes.



Two-Speed Aux. Transmission Doubles the number of transmission gear ratios. Provides low gear ratio for full power at extreme low speeds in tough, cross-country operations.



Full Torque P.T.O. . . . Utilizes full engine power through all transmission speeds. Exclusive safety lock prevents truck drive while boring.

Fully Compensated Drive Three free-acting differentials compensate for differences in travel of all four wheels. Reduces drive line strains, eliminates needless tire scuffing.

With extra traction and "go everywhere" mobility FWD "Mobilized Tools" for line construction or maintenance pay off for you in speed . . . to the job . . . on the job. And, you'll get all-weather service . . . greater safety for crews and equipment . . . longer, trouble-free life. When you use FWD "Mobilized Tools," you deal with only one source for service and supply.

To get the facts . . . details on the more than 78 matched-combinations utilities can choose from . . . see your FWD Dealer or write direct.

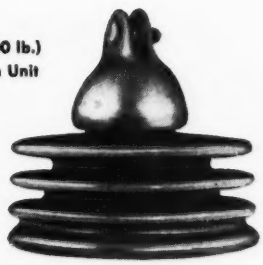
THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin • *Canadian Factory*: Kitchener, Ontario

Built by the makers of America's Foremost Heavy-Duty Trucks

LET THE WEATHER TAKE OVER

YOUR INSULATOR-SCRUBBING CHORE

Lapp Standard (15,000 lb.)
Fog-Type Suspension Unit



Lapp High-Strength (25,000 lb.)
Fog-Type Suspension Unit

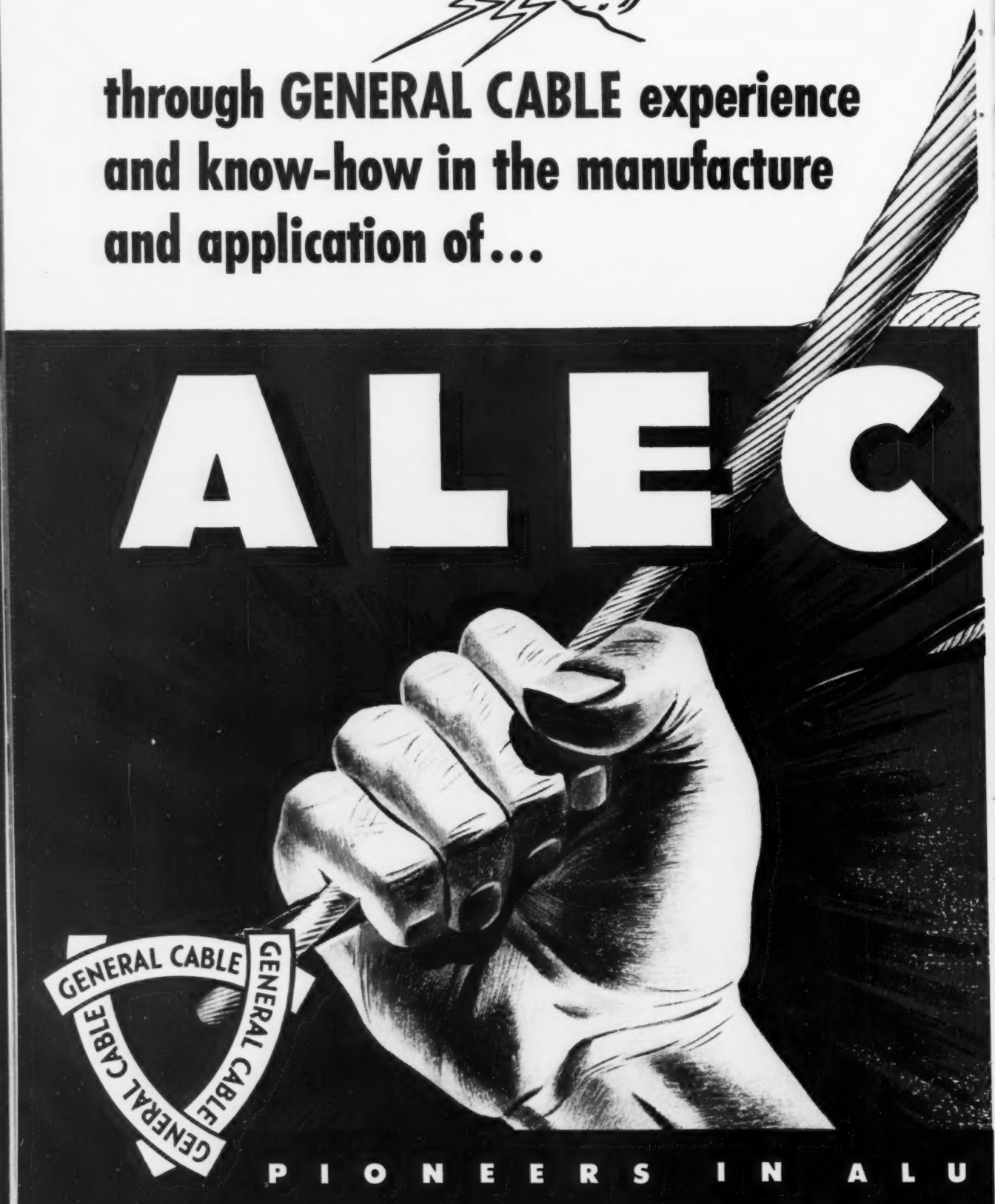
Industrial progress is wonderful! It builds load, increases national wealth, and is our hope for Peace by making us a formidable potential military power. But more and more industrial processes bring more and more contamination to transmission insulators. And some of it is sure hard to get off! Lapp Fog-Type design has a long record of successful service in areas of most severe salt fog, dust and industrial fumes. 56% more leakage distance than standard units gives it a big initial advantage. More uniform leakage path avoids arc-starting hot spots. And petticoat shape and spacing are such that wind and rain flush off accumulated dirt.

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, NEW YORK

"More Power to You"®

through GENERAL CABLE experience
and know-how in the manufacture
and application of...



TRAL

ALUMINUM

WIRES and CABLES

Twenty years ago, ALECTRAL pioneered the use of aluminum as a conductor for all purposes. The name was assigned to wires and cables of high tensile strength *aluminum*, engineered as solid or stranded conductors for transmission and distribution service.

Today General Cable can supply all types of ALECTRAL, including ALECTRAL-ACSR (bare and weatherproof), ALECTRAL Weatherproof ("O.K.", "Peerless", "Tip-Top" and Polyethylene covered) and ALECTRAL Insulated Service Drop and Entrance Cables.

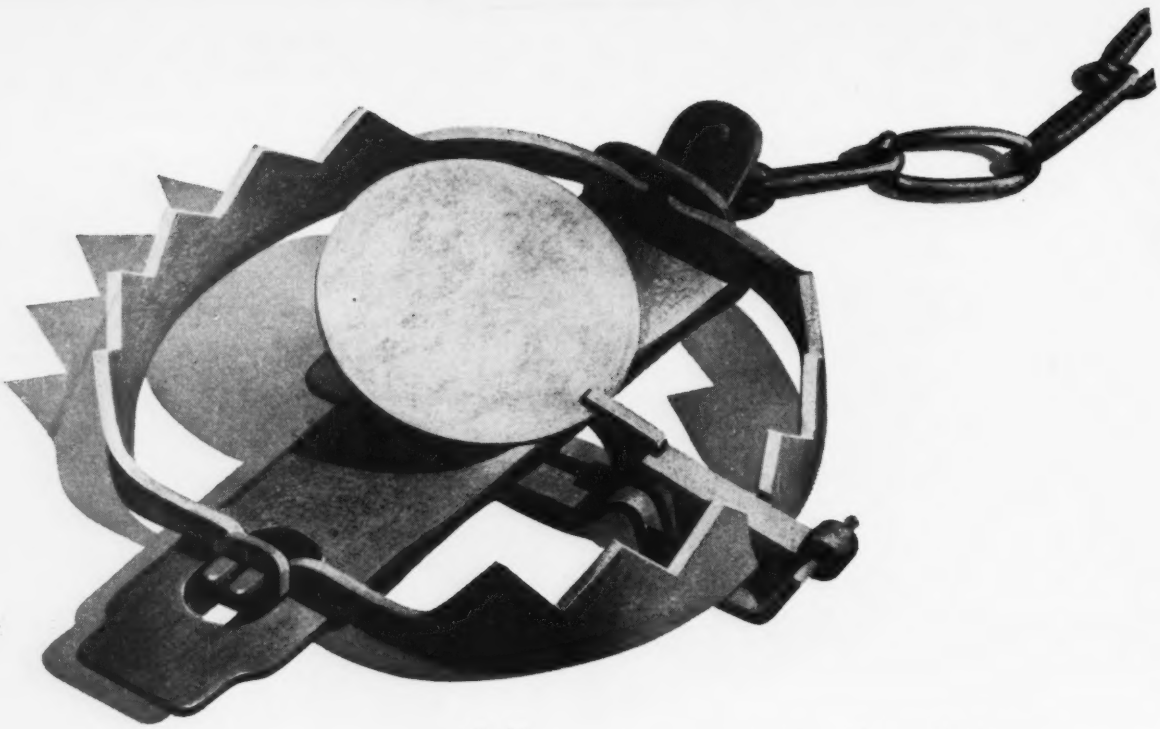
General Cable manufacturing and field experience with aluminum conductors well qualifies our engineers to offer intelligent and practical counsel to the many who are planning to use aluminum conductor cables on current or future projects.

GENERAL CABLE
CORPORATION

EXECUTIVE OFFICES: 420 LEXINGTON AVENUE, NEW YORK 17, N. Y. • SALES OFFICES IN PRINCIPAL CITIES OF THE UNITED STATES

"ALECTRAL", O.K. "PEERLESS" AND "TIP TOP" ARE REGISTERED TRADE MARKS OF GENERAL CABLE CORPORATION

M I N U M W I R E A N D C A B L E



All over your building,
fire sets its traps. In switch gear,
transformer vaults, sub-stations.
In fact, wherever it can
stop your business in its tracks.
Make sure you don't fall victim.
Post a KIDDE Portable Extinguisher
next to every fire hazard.

Kidde

Walter Kidde & Company, Inc.,

330 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

Punched and formed pieces of tough, resilient National Vulcanized Fibre reinforce spectacle case to provide lasting shape retention and serviceability.

contributes to an improved product – in spectacle cases for American Optical COMPANY

National Laminated Plastics
nationally known—nationally accepted

This practical use of National Vulcanized Fibre by American Optical Company in their attractive spectacle cases is typical of the countless contributions National Vulcanized Fibre—*the material of a million uses*—makes to industry and business.

National Vulcanized Fibre applications, both mechanical and electrical, are varied and extensive. In mechanical applications it is desirable because it possesses exceptional tensile and crushing strength, toughness, density and resistance to wear—coupled with ease of fabrication. It actually improves with age; for many mechanical purposes it is better, more durable than metal.

In the electrical field National Vulcanized Fibre has been the standard insulation for years. It has high dielectric strength and, when subjected to hot electrical arcing, it evolves neutral gas which extinguishes arc without "tracking." Many electric appliances find National Vulcanized Fibre to be the *one best material* for one or more of their parts.

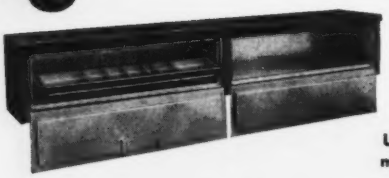
Available in various grades and colors; and in sheets, rods, tubes and special shapes. Write for detailed literature and engineering service information—

NATIONAL VULCANIZED FIBRE CO.
Wilmington Delaware

Offices in Principal Cities
Since 1873

The name for "utility" in Utility Bodies

Line Construction Bodies
(with or without crew compartments)
(Standard or Low Floor Design)

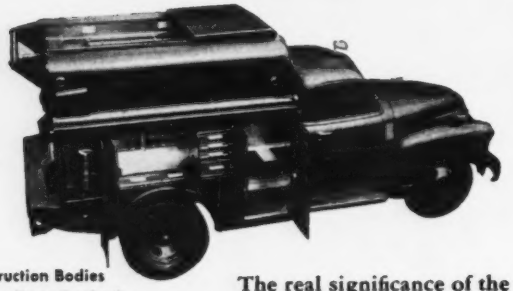


Utility compartment assemblies

New Series 2100 all-hydraulic Aerial Ladder

HOLAN

Heavy-Duty Hydraulic Towers



Light Line Construction Bodies
(Standard or Low Floor Design)

General Service Bodies

The real significance of the name HOLAN on a Utility Body lies in the engineered manufacturing that incorporates the newest, the best and ALL of the special features which insure true "utility" to the user. Maximum usefulness, based on the line crew or servicemen's actual needs in each utility assignment, is engineered into every Holan unit . . . whether it's for light or heavy line construction, with or without crew compartments, with standard or low floor, pole handling rigs, towers, ladders, crew carriers or light general service bodies. The many utility companies using Holan equipment can tell you how this pays off on the job.

DISTRIBUTORS

Baker Equipment Engineering Co.
Summit and Norfolk Sts., Richmond, Va.

Baker Equipment Engineering Co.
2401 Hutchinson Ave., Charlotte, N. C.

Baker Equipment Engineering Co.
Shop Road, Columbia, S. C.

Schetky Equipment Corp.
1810 S. E. 10th Ave., Portland 14, Ore.

There are detailed spec sheets for every Holan unit

J. H. HOLAN CORPORATION

BODIES AND ACCESSORIES FOR UTILITIES
4100 West 150th Street — Cleveland 11, Ohio

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Offices in Principal Cities
Since 1873

INSTALLED 1942

It has an Unmatched Field Performance Record of Trouble-Free Service!

This C-D 20,160 Kvar capacitor bank installed by a major northwestern power producer in 1942, has an outstanding record for low-maintenance operation. Another typical time-tested C-D installation!

Ask to have a C-D engineer point out the low-maintenance characteristics that are built into every C-D capacitor. Cornell-Dubilier Electric Corp., Dept. D-23A, South Plainfield, N. J.

CORNELL DUBILIER

CONSISTENTLY DEPENDABLE

CAPACITORS

PLANTS IN SO. PLAINFIELD, N.J. • NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS. • PROVIDENCE, R.I. • INDIANAPOLIS, IND. • FUQUAY SPRINGS, N.C. • SUBSIDIARY, RADIART CORP., CLEVELAND, O.

80 years ~~old~~ young

Age in itself means very little. But age accompanied by historic achievements and age that is continuing to produce the finest products of their type is something of which we are proud.

1873

Founded in 1873, The R. Thomas and Sons Company very early became closely allied to the electrical industry.

1885

In 1885, the first "Thomas Quality" insulator was produced, the first shipment going to the U.S. Electric Lighting Co., Chicago.

1893

In 1893, all of the porcelains used in the lighting arrangement for the World's Fair at Chicago, installed by Westinghouse, were Thomas.

1896

In 1896, Thomas perfected the first multi-part, high-voltage, pin-type insulator. It was known as the "Boch" Glaze-Filled Insulator, later to be patented under No. 600,475. It represented the initial step toward making possible the transmission of electrical energy at higher voltages.

1907

In 1907, Thomas designed and made the first cap-and-pin suspension insulator. Units installed that year are still giving trouble-proof service after 46 years of continuous operation.

1917

In 1917, we introduced the Thomas link-type Hewlett suspension insulators. Insulator failure being virtually unknown with this design, it is easy to understand why hundreds of thousands are still giving satisfactory service today.

1938

In 1938, Thomas engineers pioneered and were first to develop the under-glaze metallic oxide coating that guarantees the "noise-free" operation of the patented Thomas "Q-T" Insulators. (Patent No. 2154387)

These are among the many Thomas "Firsts" and contributions which have helped the Electrical Industry reach its present position.

TODAY, in our 80th year, we are ready with improved facilities and increased capacity to meet the most exacting needs of the Industry. After all is said, it's still quality that counts plus proper designing, precision manufacturing . . . and PROOF OF PERFORMANCE. Why gamble?

The R. Thomas and Sons Co.

LISBON, OHIO

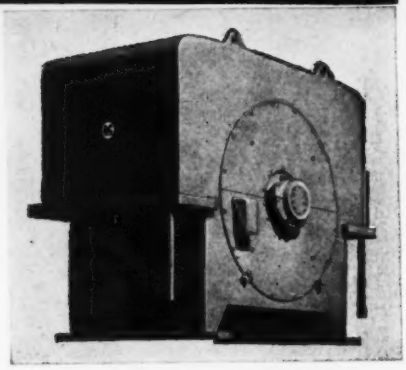
NEW YORK CHICAGO

Sales Representatives: **C. G. Anderson,** *Chicago* • **E. B. Anderson Co.,** *Detroit* • **Conrad R. Bangh,** *Omaha* • **Ken H. Best,** *Seattle* **R. E. Cunningham & Son,** *Los Angeles* • **W. H. Eddy Electric Products, Inc.,** *Phoenix* • **Engineer Sales Co.,** *St. Petersburg* • **Electrical Distributors Co.,** *Philadelphia* • **Hamilton Associates,** *Denver* • **Geo. E. Hann Co.,** *San Francisco* • **Hugo Sales Co.,** *Minneapolis* • **John G. Pettijohn Co.,** *Knoxville* • **H. E. Ransford Co.,** *Pittsburgh* • **J. F. Schaefer & Co.,** *Kansas City* • **R. J. Sullivan Co.,** *Boston* • **Tafel Electric & Supply Co.,** *Louisville* • **Walter E. Thompson Co.,** *Birmingham* • **Triangle Electric Supply Co.,** *El Paso* • **United Electric Supply Co.,** *Salt Lake City* **Williamson Sales Co.,** *Shreveport, Amarillo, Corpus Christi, Dallas, Houston, New Orleans, Pine Bluff* • *Representatives in other principal cities*

1953
Thomas QUALITY
INSULATORS AND
ACCESSORY HARDWARE

NO HOUSING PROBLEM

. . . with this Outdoor Motor



BEST WAY to solve a housing problem is to eliminate the need for housing! That's exactly what the Allis-Chalmers weather-protected motor does. It eliminates the need for a costly building . . . costly in added capital investment, costly in upkeep, and costly in extended construction time.

Proved by Special Tests

We know this weather-protected design can give you these savings . . . plus dependable performance . . . because we've tested it under extreme conditions.

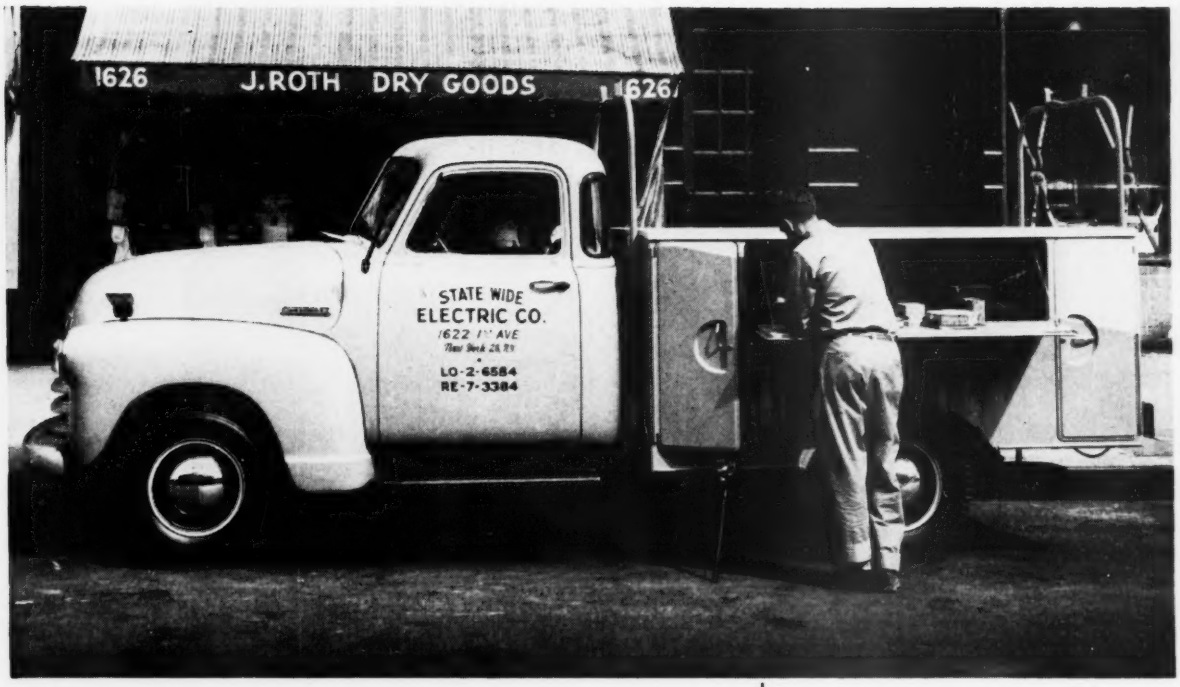
Take the 900-hp, 435-rpm, 4160-volt motor shown above. While running at normal speed and voltage, it was deluged with water at rates up to 40 inches per hour — driven by winds up to 75 miles per hour. This was done repeatedly from all angles. But on inspection, no moisture was detected on the windings of this weather-protected motor.

And other tests checked its effectiveness in keeping out wind-driven fine sand.

Bulletin Describes Features

The construction features that provide this economical, super-splashproof performance are available in ratings for all major auxiliary drives. For more information, ask your nearby A-C representative for Bulletin 05R7874, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3907

ALLIS-CHALMERS



4 powerful reasons why you get more of what you want in 1953 CHEVROLET Advance-Design Trucks

MORE TRUCK FOR LESS MONEY! Chevrolet trucks list for less than any others of comparable specifications. Yet they bring you features and advantages found in few other trucks. For example, the advanced Loadmaster engine—standard in 5000 and 6000 Series heavy-duty and forward-control models (optional on 4000 Series heavy-duty trucks)—now has a new high-compression ratio of 7.1 to 1, and delivers even more horsepower than before.

FACTORY MATCHED TO YOUR JOB! Every unit of the Chevrolet truck you buy is balanced to the job. Tires, axles, springs, engine, frame, body and brakes form a team carefully engineered for the greatest efficiency—and the lowest cost.

GREATER VALUE IN FEATURE AFTER FEATURE! Two great valve-in-head engines—the Thriftmaster and the Loadmaster—provide greater gasoline economy. Hypoid Rear Axle, Unit-Designed Bodies, Flexi-Mounted Cabs and many other Advance-Design features offer value unmatched by any other truck at such low cost.

MORE RUGGED THAN EVER! In 1953, Chevrolet trucks are even sturdier. Bigger, more durable brakes on many models; heavier, more rigid frames and stronger construction lengthens truck life and lowers your hauling costs. See your Chevrolet dealer. Chevrolet Division of General Motors, Detroit 2, Michigan.

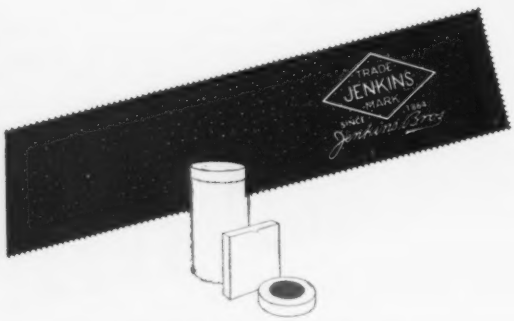
CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

TWO GREAT VALVE-IN-HEAD ENGINES—the Loadmaster or the Thriftmaster—to give you greater power per gallon, lower cost per load. **POWER-JET CARBURETOR**—for smooth, quick acceleration response. **DIAPHRAGM SPRING CLUTCH**—for easy-action engagement. **SYNCHRO-MESH TRANSMISSION**—for fast, smooth shifting. **HYPOID REAR AXLE**—for dependability and long life. **TORQUE-ACTION BRAKES**—on light-duty and medium-duty models and on front of heavy-duty models. **TWIN-ACTION REAR BRAKES**—on heavy-duty models. **DUAL-SHOE PARKING BRAKE**—for greater holding ability on heavy-duty models. **CAB SEAT**—with double deck springs for complete riding comfort. **VENTI-PANES**—for improved cab ventilation. **WIDE-BASE WHEELS**—for increased tire mileage. **BALL-GEAR STEERING**—for easier handling. **UNIT-DESIGNED BODIES**—for greater load protection. **ADVANCE-DESIGN STYLING**—for increased comfort and modern appearance.

CHEVROLET
first in demand
in value
in sales

lasting "tack"

When the weather's cold and wet,
Gold Seal Tape sticks to the job.
Sticks when it's hot, too . . . won't smear
or dry out. A few wraps, and the job's finished . . .
one thickness insulates. Try it.
See how it saves time and trouble . . .
see why it's the
electrical worker's favorite.
Jenkins Bros. (Rubber Division),
100 Park Ave., New York 17.



FRICTION AND RUBBER TAPES
In 10-roll cartons or single rolls.
Every roll sealed in cellophane, stays fresh.

JENKINS

Gold Seal Tape

Jenkins Bros. also make
Diamond Seal Friction and Rubber Tapes
which meet ASTM Specifications.

A PRODUCT OF JENKINS BROS....

MAKERS OF FAMOUS JENKINS VALVES

TYPICAL ANACONDA JOINTING KIT contains: lead sleeve, connector, solder, flux, paper pasters, insulating and shielding tape, filling compound, flushing compound, cotton yarn and tape, waste ends—and complete instructions. The kits are easy to order by catalog number.

ANACONDA JOINTING KITS

Here's how to make sure your stockroom doesn't overlook a *single vital item* . . . and your cable-installation crews have everything they need for a specific joint.

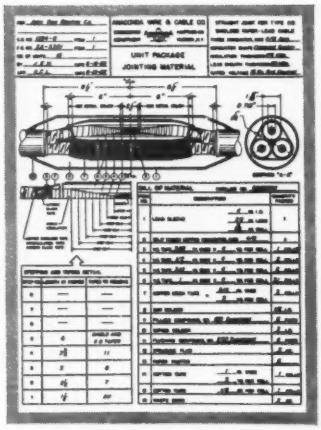
A single forgotten item lies on the stockroom shelf miles away. Your jointer has to stop work!

Someone grabs the wrong material in a hurry. The result is the same—wasted time and labor costs.

The remedy lies in the ANACONDA Unit Package of Jointing Material shown in the illustration above. Here in one conveniently-packaged kit is everything for one complete joint on a specific type and size of cable—impregnated-paper, varnished-cambric, rubber or thermoplastic. The kit is tailored to fit the cable perfectly.

Nothing has been left out. It's complete to a bill of materials and easy-to-follow instructions that assure a neater and better job. Every item has been laboratory- and service-proven—designed by power-cable specialists.

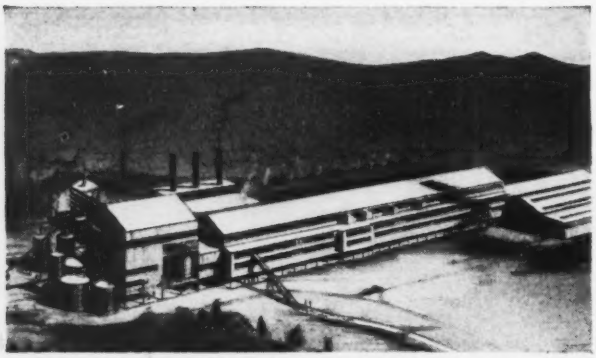
To keep pace with the increasing demand for ANACONDA Accessories, it has been necessary again to greatly increase the facilities of the Cable Accessories Department. This Department is now in a position to promise prompt shipment on most of your orders. Your Anaconda Representative can help you select suitable accessories from our complete line of potheads, insulating compounds, jointing kits, paints, connectors, etc. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 52463



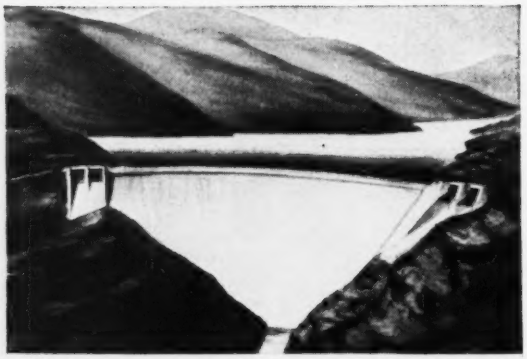
BILL OF MATERIAL and sketch with dimensions are included . . . a handy check-guide for proper jointing technique!

Accessories for all types and sizes of bare and insulated conductors.

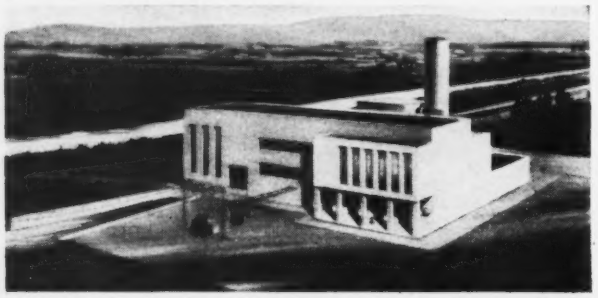
ANACONDA®



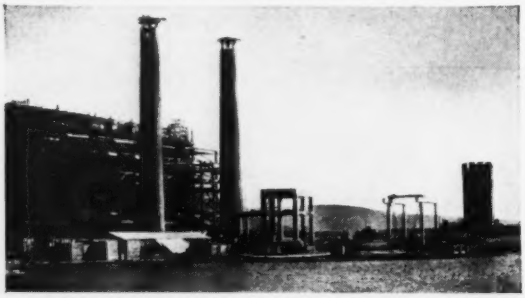
IT TAKES MANY SKILLS to build a newsprint mill, even more to build the *first* one in India! That's what EBASCO is doing at Nepanagar, India. Purchase of equipment and supervision of installation and operation are part of EBASCO's responsibility.



IN JAPAN, as a member firm of Overseas Consultants, Inc., EBASCO is supervising design and construction of this dam. To be part of the Kamishiiba Hydro-Electric Development of the Kyushu Electric Power Co., it will be the first arch dam constructed in Japan.



ON THE PO RIVER, near Torino, Italy, the Moncalieri Steam Electric Station will be constructed. EBASCO engineers are handling the design of this 37,500 KW plant and, in addition, purchasing and expediting materials and equipment for the Azienda Elettrica Municipale di Torino.



MODERN GREECE meets ancient Greece where the Aliveri Steam Electric Station is being built, as part of a new power system. At the right of the photo, stands a centuries-old signal tower. When completed the new system will include 3 hydro plants.

HOW ONE U. S. FIRM IS HELPING TO BUILD A BETTER WORLD

For nearly fifty years EBASCO has been one of the world's leading firms of engineers, constructors, and business consultants. The design and construction services of EBASCO are utilized by large and small companies in practically every field of business and industry in the United States. Today, in addition to its clients in this country, EBASCO is serving many clients in foreign countries—helping them rebuild war-torn nations, speed industrial progress, and introduce modern technological improvements.

Pictured on these pages are six typical EBASCO projects overseas, illustrating the many different types of installations EBASCO handles from start to finish. Because EBASCO integrates many skilled men and many specialized services into one smooth-working organization, it is equipped to do an entire job, or any phase of it, any place in the world.

If you need a new plant . . . or want to improve your present facilities . . . EBASCO can help you. We have a booklet called "The Inside Story of Outside Help" that describes our services in detail. May we send you a copy? Address: Ebasco Services Incorporated, Dept. M, Two Rector St., New York 6, N. Y.

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ENGINEERS · CONSTRUCTORS · EBASCO · BUSINESS CONSULTANTS

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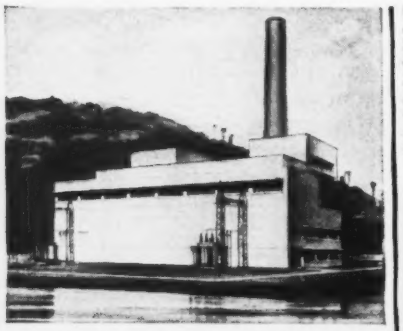
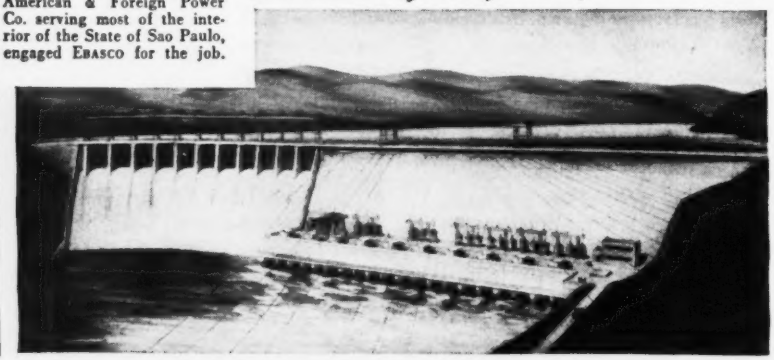
Ebasco Teamwork gets things done anywhere in the world



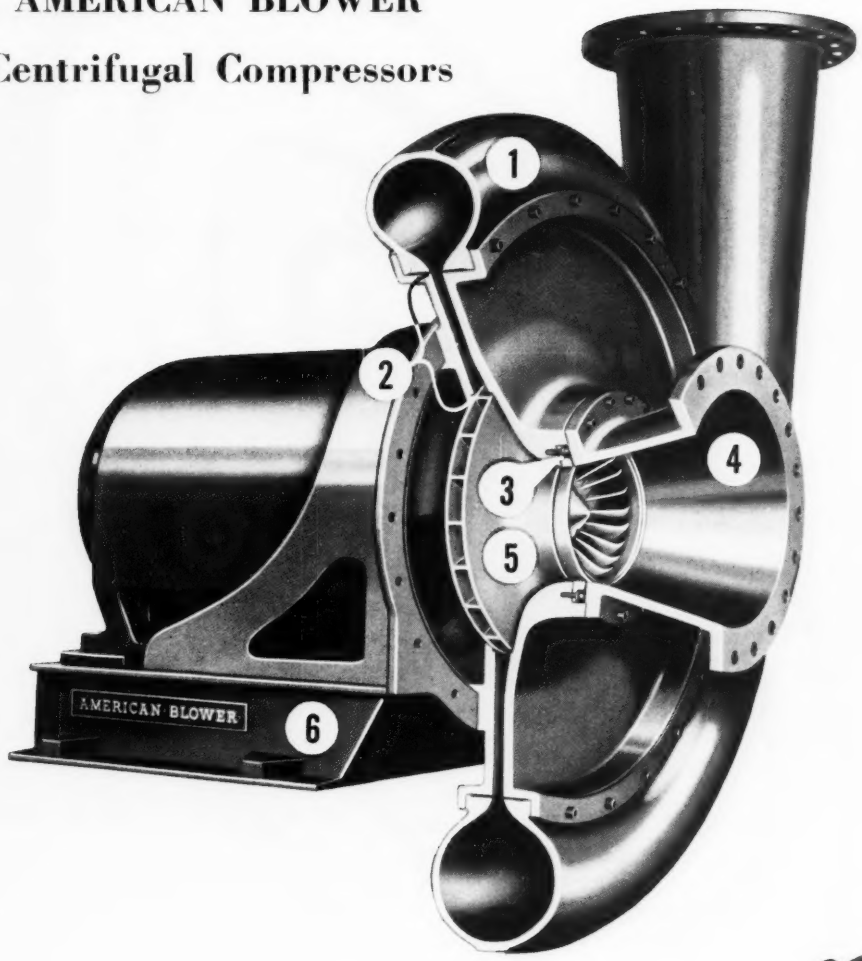
INDIA'S Bombay Harbor is the location of the Trombay Thermal Electric Station, a 125,000 KW plant. EBASCO is handling the engineering and construction, the training of Indian personnel and starting up of this modern station which embodies semi-outdoor design for the Tata Power Co., Ltd.

IN BRAZIL, the Piexoto Hydro-Electric Development will have an ultimate capacity of 400,000 KW. *Cia Paulista de Forca e Luz,* a subsidiary of American & Foreign Power Co. serving most of the interior of the State of Sao Paulo, engaged EBASCO for the job.



AMERICAN BLOWER

Centrifugal Compressors



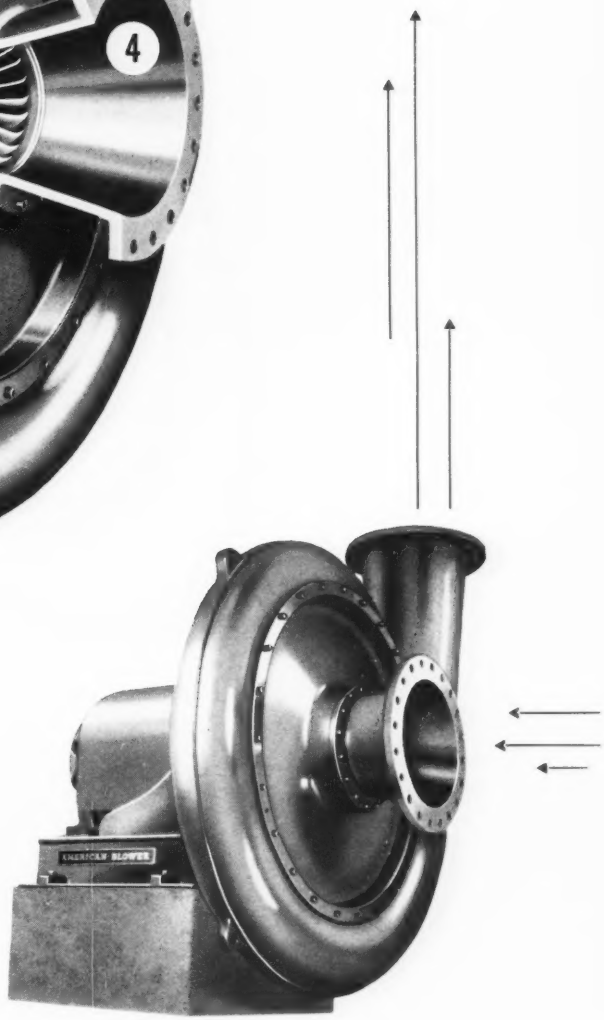
American Blower Centrifugal Compressors offer outstanding design features which improve efficiency, facilitate installation and minimize maintenance.

In the cutaway view, above: (1) Improved, scroll-shaped, casing design increases compressor efficiency. (2) Unobstructed diffuser passage efficiently converts velocity energy into pressure. (3) Annulus packing, having machined labyrinths, minimizes recirculation of gas around the impeller inlet. (4) Removable inlet nozzle. (5) Aerodynamic design of impeller blades results in high efficiencies. (6) Welded-steel baseplate "stress relieved" prior to machining, assuring maintained alignment.

For data, ask our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation



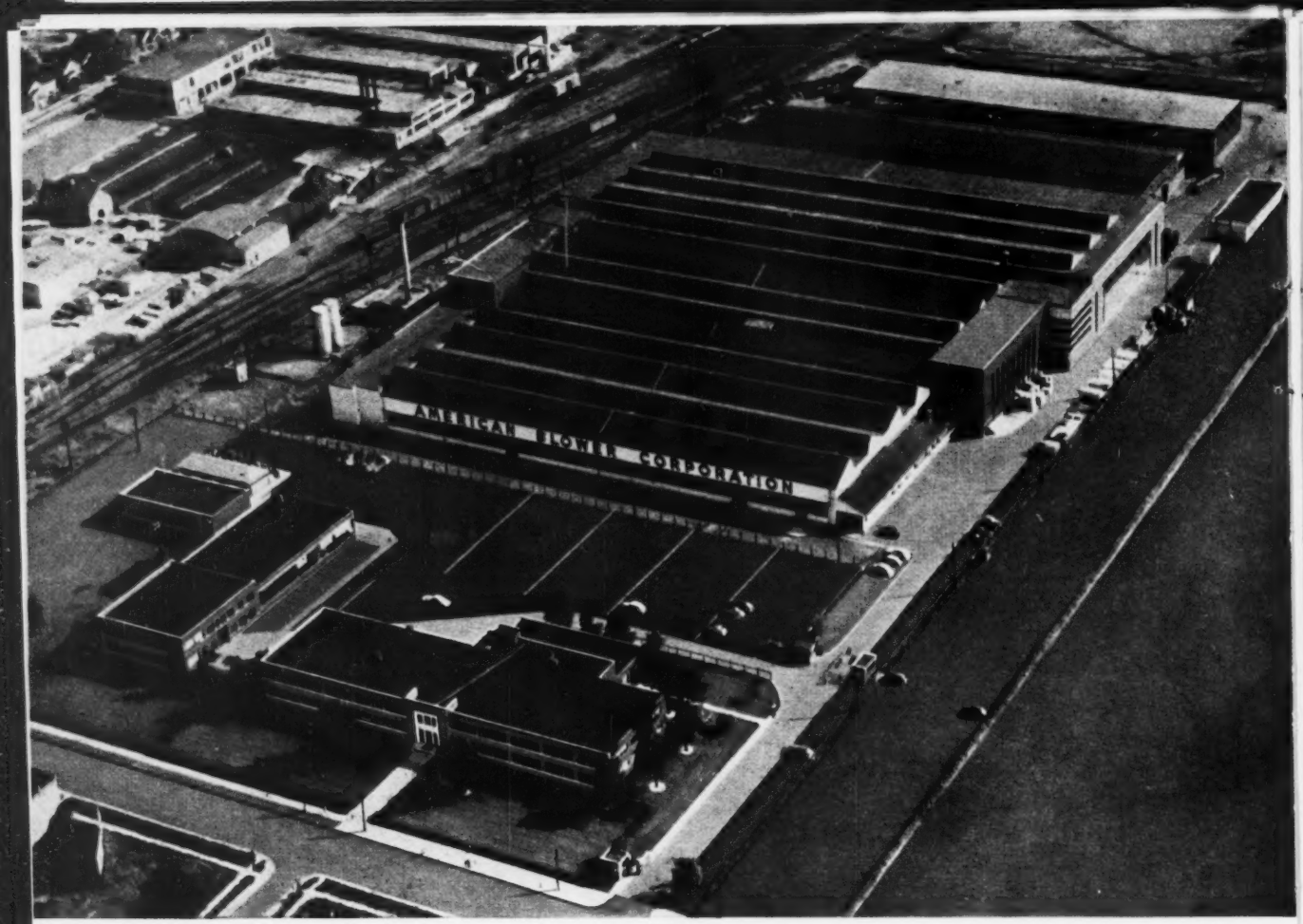
American Blower Single Stage Centrifugal Compressors are available in sizes 30 to 600 h.p., and pressures $1\frac{1}{4}$ to $3\frac{3}{4}$ lbs.

AMERICAN BLOWER

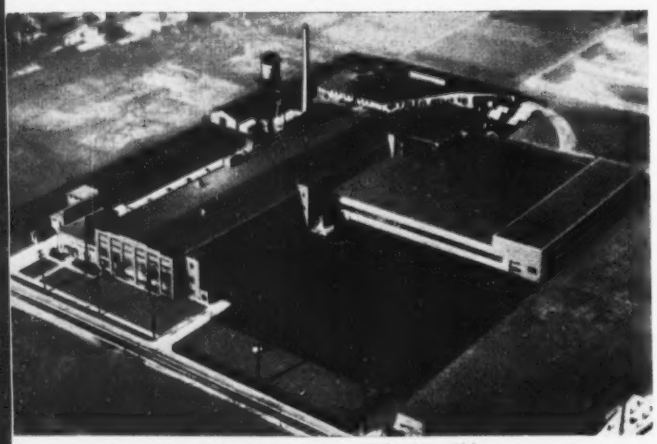
YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATER



American Blower main plant and office, Dearborn, Mich. Here are located the finest research and sound laboratories and engineering facilities in the industry.



American Blower Plant, Columbus, Ohio

You will find, in these modern plants, every facility for research, testing and manufacturing Mechanical Draft Equipment, Dust Precipitators and Gyrol Fluid Drives for power plants, as well as for the manufacture of a complete line of Air Handling Equipment for industrial and commercial needs. You are cordially invited to visit our plants and inspect our modern facilities.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
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Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER
CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATER

Canadian Sirocco Company, Ltd., Plant, Windsor, Ontario

American Blower Plant, San Leandro, California

does your line wire covering match

BAKELITE POLYETHYLENE?

TRADE-MARK

Give it the test ! Check it for all these features offered by BAKELITE Polyethylene:

Light weight—specific gravity only 0.92, reducing span load, permitting greater distance between poles.

Easy handling—thinner wire covering because of remarkable mechanical and electrical properties. Smooth waxlike surface aids in pulling and stripping. Abrasion resistance—excellent.

Wide temperature range—retains toughness and flexibility at —70 deg. C., resists deformation up to 90 deg. C.

Resistance to water and corrosive atmospheres—unaffected by oils, acids, alkalies. After two years' immersion in water, properties show little or no change.

Flame resistance—burns only where direct flame is applied, without noxious gases or smoke. Burning ceases a few inches on each side of flame.

Long life—Ten years outdoor weathering data and accelerated aging of black polyethylene compound indicate a life span of several decades. This covering stays flexible—holds fast—won't festoon.

BAKELITE Polyethylene meets ASA suggested specifications (second draft: July 20, 1952) for weather-resistant wire and cable.

BAKELITE
TRADE-MARK
POLYETHYLENE
WIRE COVERING

!

Outstanding electrical properties for signal systems and service drop, wet or dry—at 50 megacycles and 25 deg. C., power factor is only 0.0005; dielectric constant only 2.35. These values hold through the range from 60 cycles to 5×10^5 cycles. Operating temperatures up to 90 deg. C. have little effect on electrical properties. Insulation resistance is too high to measure on conventional testing devices. BAKELITE Polyethylene excels in resistance to voltage breakdown.

Write Dept. OZ-63 for Kabelitems #48, which provides detailed information on BAKELITE Polyethylene.

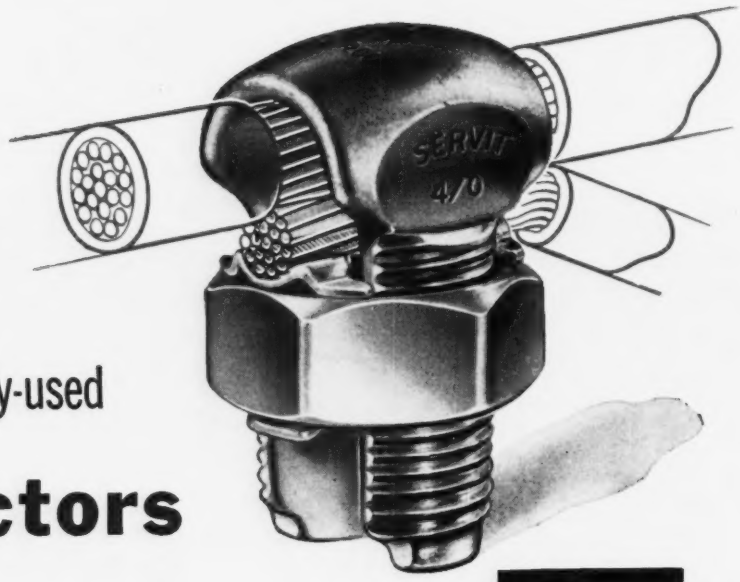
BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corp.* UCC **30 East 42nd Street, New York 17, N. Y.**

Why are these

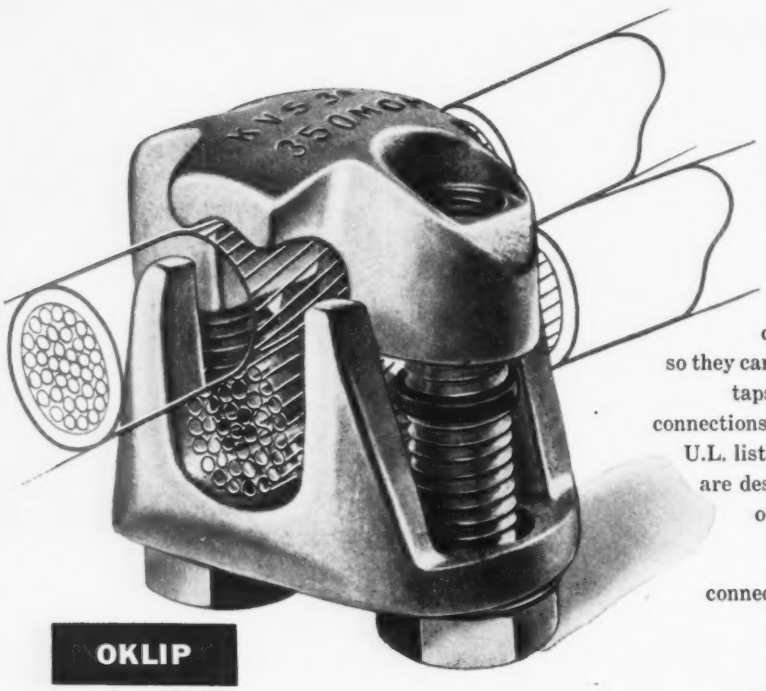
the most widely-used

connectors

in America?



SERVIT



OKLIP

Because Burndy Servits and Oklips are *engineered* of high-strength alloys – to provide the high mechanical strength that assures sound electrical connections. Because they're compact – easy to install, easy to tape. Because they withstand overload, vibration stresses, corrosion conditions, and high tightening torque – so they can be used *over and over again* for splices, taps, deadends, light or heavy-duty service connections – indoors or outdoors. Because they're U.L. listed. Because Servit and Oklip variations are designed to accommodate any combination of copper, aluminum or steel conductors.

For long years of trouble-free service connections, it pays to *specify* Burndy Servits and Oklips. *And be sure you get them!*

ALWAYS . . . consult Burndy Catalog 50 – your basic source of all connector information.

BURNDY

53-2 **BURNDY ENGINEERING COMPANY INC.,** NORWALK, CONNECT. **BURNDY CANADA LTD.,** TORONTO 8, ONT.

For faster, safer clearance that lasts for years

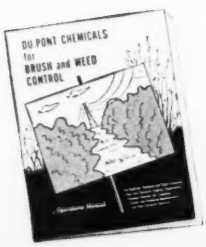
Kill Brush with DuPont Ammate®

Many users report one spray with Du Pont "Ammate" kills brush so thoroughly that repeat sprays are not needed for years.

In most cases, when the original spray job is done well, brush is kept under control with nothing more than occasional spot sprays starting five or more years later. This assures lower cost brush control with less work for your maintenance crews or custom sprayers.

Here's why "Ammate" works so well.

- **Kills roots of brush as well as tops, yet allows low-growing natural cover to come back.**
- **Control lasts for years, saves labor of hand cutting or annual spraying.**
- **Reducing to a minimum the hazard of damage by spray drift.**
- **Not hazardous to operators, livestock or wildlife. Nonflammable.**



Free illustrated booklet describes how to control brush in rights of way with Du Pont "Ammate." For your copy, write Du Pont, Grasselli Chemicals Dept., Wilmington, Del.

On all chemicals always follow directions for application. Where warning or caution statements on use of the product are given, read them carefully.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

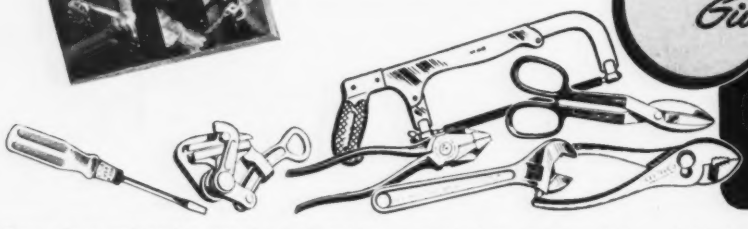
WORLD'S *most imitated* WRENCH

● CRESCENT is the original 15° angle adjustable wrench. Despite the fact that no other wrench has been so widely imitated, sales of CRESCENT and CRESTOLOY WRENCHES are approximately equal to sales of *all* competitive makes combined. The reason for this overwhelming preference is CRESCENT'S demonstrated quality and outstanding value . . . the result of untiring technological research and continuous product improvement.

FREE BOOK

Has all the answers. It tells what tools to use and how to use them. Fully illustrated. A postcard will bring it to you. Send today.

CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan
Symbol of Excellence



Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

Use of G-E Super Coronol* Cable helps solve difficult cable layout problem

Installation speed important feature of G-E interlocked armor cable system

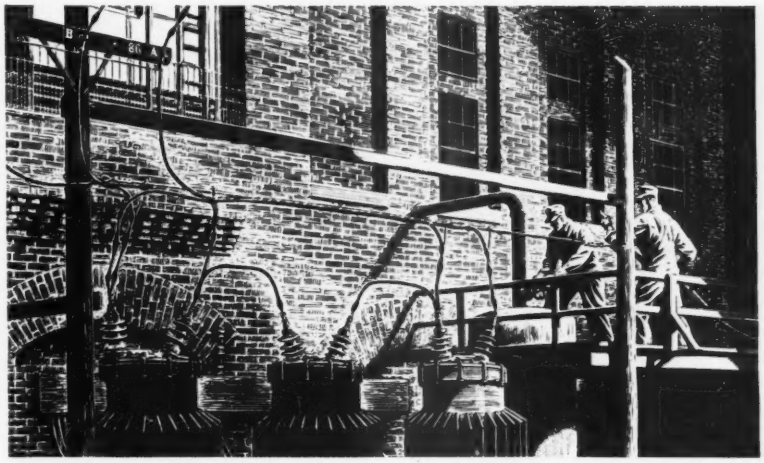
Here's a thought for rewiring plants in a hurry, keeping costs in line, and possibly maintaining production at the same time: Investigate the G-E V-c interlocked armor cable system.

The ease and speed with which this interlocked armor cable system can be installed lowers costs. The cable can be laid quickly—indoors or outdoors—in long lengths, around corners, on low-cost aluminum racks. Engineering time is cut. Threading or bending of conduit is eliminated. Splices are of a simple, mechanical type. Many plants have saved months, not days, because of these features.

Permanent

To our knowledge, no installation of interlocked armor cable has ever suffered mechanical damage sufficient to cause electrical failure. The cable is versatile as well as permanent and makes a neat, clean-looking installation. A booklet that describes the G-E No. 1799 varnished-cambric-insulated interlocked armor cable system is available.

Flexibility of interlocked armor cable is demonstrated here—corners and projections present no installation problems.



The cable layout for these transformer leads was suggested by a G-E wire and cable specialist. The layout resulted in an important improvement in safety and appearance.

Ionization testing standard G-E procedure

In order to make certain that the cable has been properly constructed, G. E. makes an ionization test of every foot of Super Coronol cable rated over 5 kv. This is standard practice. Even continuous lengths as long as 3100 feet have been tested on special equipment made for this purpose. It is tests like these that help to insure the dependability of all G-E cable. If you wish, a G-E wire and cable specialist can furnish additional information about ionization testing.

On any cable problem you can get prompt, expert help from your G-E wire and cable specialist. Here is an example. In the Omaha Public Power District a local brewery was confronted by this hazard—bare wire was used for the drops from an overhead 13.2-kv line to transformers. Liquid waste from vats kept the air moist. And with an elevated platform nearby, it was possible for men working on a condenser to get too close to the high voltage for safety.

In looking for the answer, the Power District asked the G-E Construction Materials Omaha office for a cable layout. The G-E wire and cable specialist submitted one—based on the use of 15-kv Super Coronol Geoprene cable. This cable, which is shielded, not only eliminated the danger from bare wires, but improved appearance as well. Because the cable was preformed in the utility's service shop, and terminations made in advance, installation was made with a minimum of shutdown time.

USEFUL BOOKLET

In one handy booklet you get informative data on G-E Versatol* Geoprene cable's installation and maintenance economies. The booklet, Pub. No. 19-390, can help you determine applications for these dependable, general purpose cables. Write for your free copy today.

*Registered Trade-mark General Electric Company

The next time you have a question on cable or want any of the booklets mentioned in this advertisement, call a G-E wire and cable specialist for expert help. You can reach him at the nearest G-E Construction Materials district office. Or, write Section W68-227, Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

You can put your confidence in—

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC

DETROIT ARSENAL

NEW WESTINGHOUSE 1000 WATT FLUORESCENT-MERCURY LAMP

—*The Cheapest Source of Mass White Light!*

Brighter, higher quality light at lowest cost—that's what engineers of the Chrysler Corporation sought for this newly erected Tank Assembly Wing of the Detroit Arsenal.

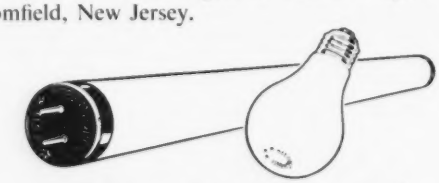
As in so many other industrial installations, the new Westinghouse 400 Watt J-H1 and the 1000 Watt C-H12 Fluorescent-Mercury Lamps met the demand for longer burning life—more economical performance due to lamps of higher efficiency—and reduced maintenance costs.

A pleasant, golden-white working light is provided by the Fluorescent-Mercury Lamp, which is both flattering to personnel and suitable for most types of lighting service. The rated lives of 4,000 to 6,000 hours respectively of the 1000 Watt C-H12 and 400 Watt J-H1 assure minimum maintenance. And the J-H1 and C-H12 may be operated from ballasts now used for the 400 Watt and 1000 Watt Mercury Lamps.

Golden-White Light Shows Real Colors. Golden-white light of Fluorescent-Mercury Lamps eliminates the need for incandescent color correction, even in color-coded assembling operations. This high-quality white light improves worker morale, aids production in industrial installations of every kind. And the long 4,000-to-6,000-hour burning life of the Fluorescent-Mercury Lamps reduces maintenance costs.

These Fluorescent-Mercury Lamps are recommended for large-scale outdoor as well as indoor applications. For 480 volt lighting circuits and for street lighting where 1000 Watt lamps are to be used, the new B-H15 is recommended.

For detailed information on how the world's least expensive source of mass white light can be employed in your present or planned lighting installations, write to Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey.



YOU CAN BE SURE...IF IT'S

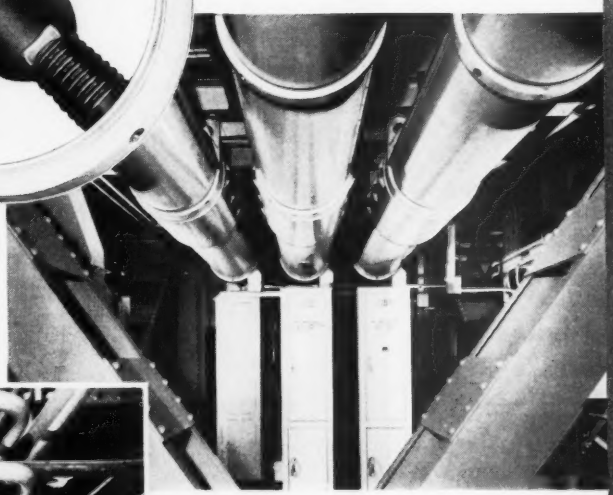
Westinghouse

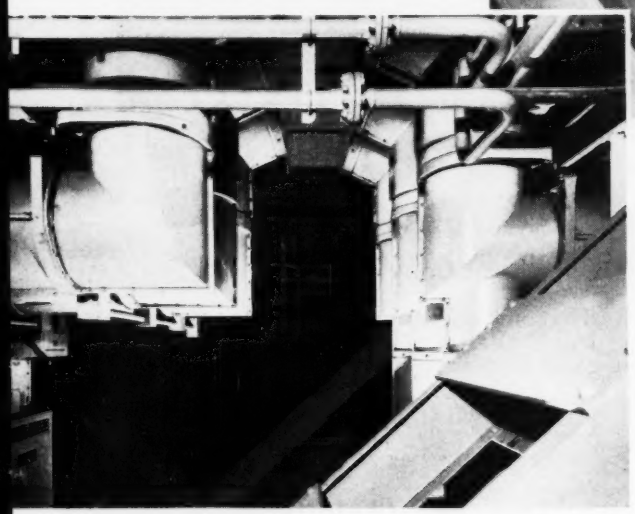
Section of bus structure with cover removed. Safety features include 6000 amp. conductor supported with insulation in compression - three phases isolated with metal enclosures.

Greater SAFETY FLEXIBILITY AND RELIABILITY

R&IE

METAL ENCLOSED ISOLATED PHASE BUS STRUCTURES





Above: Views of R&IE Bus Structures included in the 95,000 Kw. unit, new Elrama Station of Duquesne Light Company.

Check the Facts

1. Sealed, dustproof, individual bus housings provide phase isolation, and prevent interphase short circuits. Removable covers in unit sections simplify inspection if necessary.

2. Supporting ring frames equalize all stresses. Can be mounted in any position.

3. Porcelain used to best advantage - always in compression. Use of porcelain also withstands full voltage test any time after installation.

4. Conductors can be round, square, channel or bar.

5. Complete factory fabrication eliminates increasing field bus structure costs.

R&IE EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

Utility People Tell Us

This is it!

Hotpoint's Full-Sized 39-Inch Electric Range

MODEL RB 49

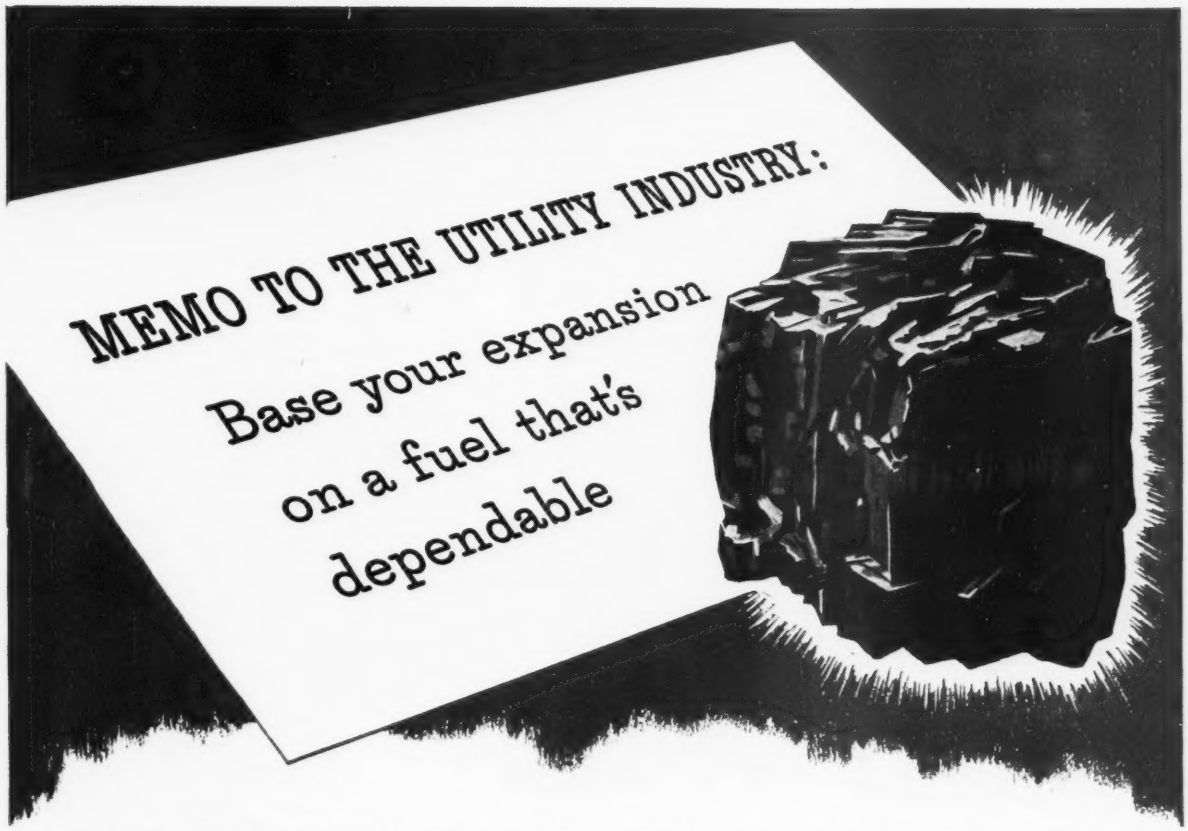
Here is a budget-priced range that offers features and performance you would expect to find in ranges selling at much higher prices.

- New Higher and Deeper Super-Oven
- Giant Hi-Speed Waist-High Broiler
- Super-Fast Instant Heat Calrod® Unit
- Three Hi-Speed Calrod Units
- Rota-Switches—Five Accurate Heats
- Automatic Temperature Control
- Electric Appliance Outlet
- Oven Indicator Light
- Large Storage Compartment
- Titanium Porcelain Finish

Knowing the problems facing progressive utility companies, Hotpoint has developed this full-sized electric range, at a low price, to assist in bringing electrical living to more families of all income levels. This is the range you've told us you need for this specific job. Have the Hotpoint distributor in your area tell you about it.

Again Hotpoint looks at Tomorrow, Today

HOTPOINT Co. *(A Division of General Electric Company)* ***5600 West Taylor Street, Chicago 44, Illinois***



• In 1951, the great machine that is America required about 370 billion kilowatt-hours of electrical energy. Estimates point to a six-fold increase in this electric power load by 1975.

Bituminous is playing a role of ever increasing importance as a source of this energy. In 1951, the electric utilities consumed approximately 102,000,000 tons, the highest on record. Alert utility executives recognize this and are planning new facilities to use the fuel that will be available in unlimited supply for years to come.

In Baltimore & Ohio territory is a large proportion of America's operating mines as well as billions of tons of undeveloped reserves. Consider these excellent quality, economically accessible coals when planning for new utility power for both the present and the future. For further advice, *ask our man!*

BITUMINOUS COALS FOR EVERY PURPOSE

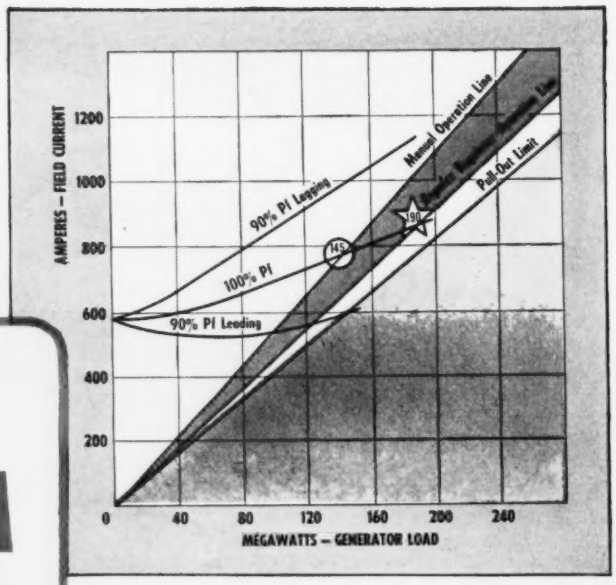
BALTIMORE & OHIO RAILROAD

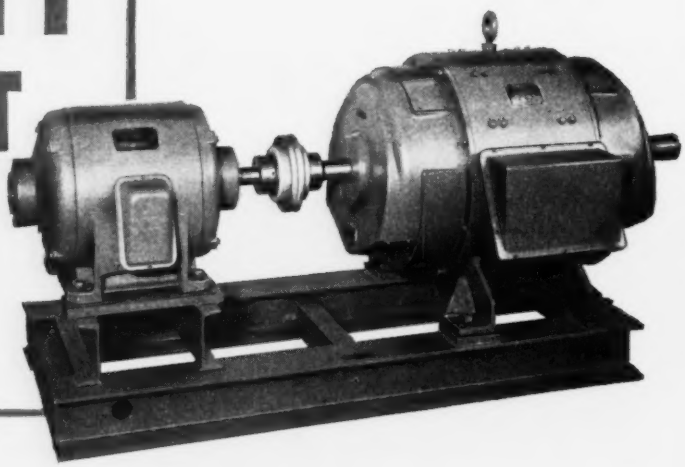
Constantly *doing things* **—better!**

ALLIS-CHALMERS
REGULEX
Voltage Regulator

AFFORDS MAXIMUM KILOWATT OUTPUT

. . . at ANY Power Factor Loading





Automatic minimum excitation provided by *Regulex* voltage regulator permits generator operation closer to the stability limit . . . much closer than manual operation permits. Thus, maximum generator pay load is assured at any power factor loading.

The Graph Tells The Story

By providing maximum stability, *Regulex* voltage regulation establishes and maintains a *safe* ratio between generator load and field current. In the graph, the gray area represents the increase in safe operating limit. The starred figure on the *Regulex* regulator operation line and the circled figure on the manual line afford a comparison of megawatt output. Note that regardless of the power factor loading, a much greater generator pay load is provided by *Regulex* regulator automatic minimum excitation.

Profit in increased kilowatt output . . . meet new demands on old generators . . . get maximum productivity out of new generator installation . . . with the *Regulex* voltage regulator. For complete information, call your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3924

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Transmission Towers by AMERICAN BRIDGE handle nation's first 330,000-volt line

● The first leg of the American Gas and Electric Service Corporation's projected high voltage transmission network has been completed with the construction of a 63-mi. 330,000-volt, double circuit link running from Appalachian Electric Power Company's Kanawha River, W. Va., station to its Philip Sporn plant.

The towers for this record-setting line were designed and fabricated by American Bridge as the result of valuable data gathered from the A. G. & E. sponsored 500,000-volt test line at Ohio Power Company's Tidd plant, Brilliant, Ohio, in cooperation with other manufacturers of high voltage transmission line equipment.

These towers are approximately 150 feet tall and carry 6 conductors of 1,275,000 C.M., A.C.S.R. expanded cable (1.6"OD). The towers are designed for straight-line spans of 1700 ft.

The technical knowledge and field experience American Bridge has acquired in this and hundreds of other transmission line installations may be just the answer to your tower problems. Our engineers welcome an opportunity to figure with you without obligation. Just write to the nearest office listed below.

AMERICAN BRIDGE DIVISION, UNITED STATES STEEL CORPORATION
GENERAL OFFICES: 525 WILLIAM PENN PLACE, PITTSBURGH, PA.
Contracting Offices in: AMBRIDGE · ATLANTA · BALTIMORE · BIRMINGHAM · BOSTON
CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DENVER · DETROIT · DULUTH · ELMIRA
GARY · MEMPHIS · MINNEAPOLIS · NEW YORK · PHILADELPHIA · PITTSBURGH
PORTLAND, ORE. · ROANOKE · ST. LOUIS · SAN FRANCISCO · TRENTON
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

DESIGN REDUCES FOUNDATION INSTALLATION COSTS. Important savings in time, labor, and materials were made possible through use of steel grillage earth anchors and variable leg extensions as shown above. Many other simplified installation and frill-free construction features are obtained through American Bridge designs.

USS TRADE MARK

AMERICAN BRIDGE

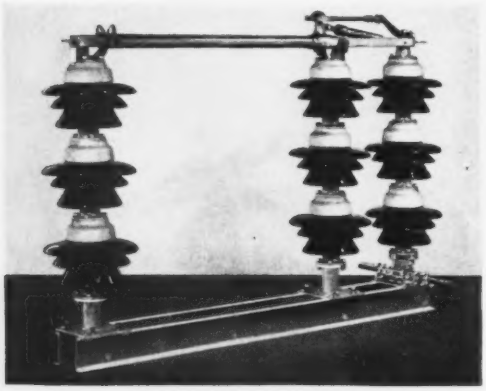
UNITED STATES STEEL

90% less wear on switch parts

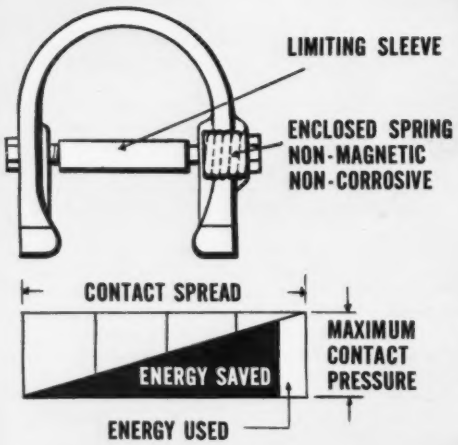
3E 8400 Airbreak Switch uses exclusive limiting sleeve for easy closure and long wear

When the blade pressure on an 8400 Airbreak Switch is released, a 3E patented limiting sleeve takes on 90% of the spring pressure. Thus when contact is closed again the switch has to rebuild only 10% of the balanced high pressure . . . the illustrations and graphs at the right show how 3E gives you these important advantages.

1. Minimum amount of energy required to set up contact pressure, resulting in minimum wear.
2. Practically no variation in contact pressure due to wear, or over or under mechanism travel.
3. Visible indication of correct contact pressure by free limiting sleeve.

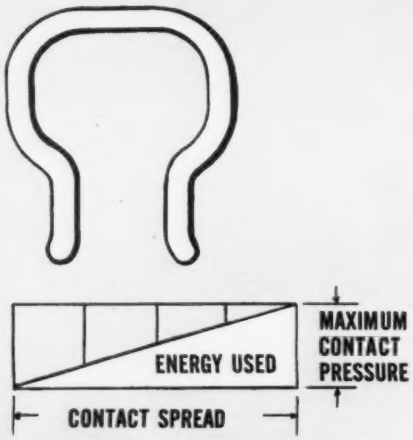


115 KV, 600 ampere, 8400 type Airbreak Switch.



MODERN 3E DESIGN

CONVENTIONAL DESIGN



3E

FOR FULL DATA WRITE
FOR NEW BULLETIN 327

8400 AIRBREAK SWITCH

ELECTRICAL ENGINEERS EQUIPMENT CO. MELROSE PARK, ILL.

UNITED STATES STEEL

TYPE "SD"

TYPE "AS"

MORE POWER

DELIVERED WITH LESS MAINTENANCE

•

Use Cast Aluminum

TYPE "AS" SUSPENSION
and
TYPE "SD" STRAIN CLAMPS

ON ALUMINUM TRANSMISSION LINES

STOP—Hysteresis and eddy current power losses.

PREVENT—Corrosion, heating and annealing damage to conductor within clamps.

ELIMINATE—Jumper splice failures—use through conductor strain clamps with continuous jumpers at strain points.

BE SURE—SPECIFY—Cast aluminum clamps with more than 25% greater strength.

Backed by many years of coordinated electrical, mechanical and metallurgical engineering knowledge and experience in the design and manufacture of cast aluminum products for the electrical industry.

WRITE FOR
Catalog No. 320

OUR PRODUCTS ARE QUALITY CONTROLLED FROM INGOT TO FINISHED PRODUCT

Consult one of our nearest 18 representatives or contact our main office

Aluminum and Bronze
POWER CONNECTORS
•
CLAMPS
•
FITTINGS and ACCESSORIES
for
SUBSTATION — TRANSMISSION — DISTRIBUTION

ABW

ANDERSON BRASS WORKS
INCORPORATED
BIRMINGHAM 1, POST OFFICE DRAWER 2751 ALABAMA

Your communications are his specialty

Here's a man who rides herd on trouble. He works in the field, guarding your power line communications against interruptions. In case of emergency, he's *out* there, ready and equipped to restore service quickly. While he works, other technicians may reroute your communications over an alternate circuit in the vast Bell System network.

This alert lineman, and lots of other specialists like him, are on *your* team when you lease communications from the Bell System.

Communications have been our special business for more than 75 years. That's why we have the best equipment and trained personnel to maintain it.

We can provide the power line industry with private-line telephone, mobile telephone, and teletypewriter services, and channels for remote metering, supervisory control and facsimile. And these are flexible services — which we expand or contract to give you exactly the communications each changing situation calls for.

• • •

Your Bell Telephone Company will be glad to study your communications problems and needs without charge.

PRIVATE-LINE TELEPHONE

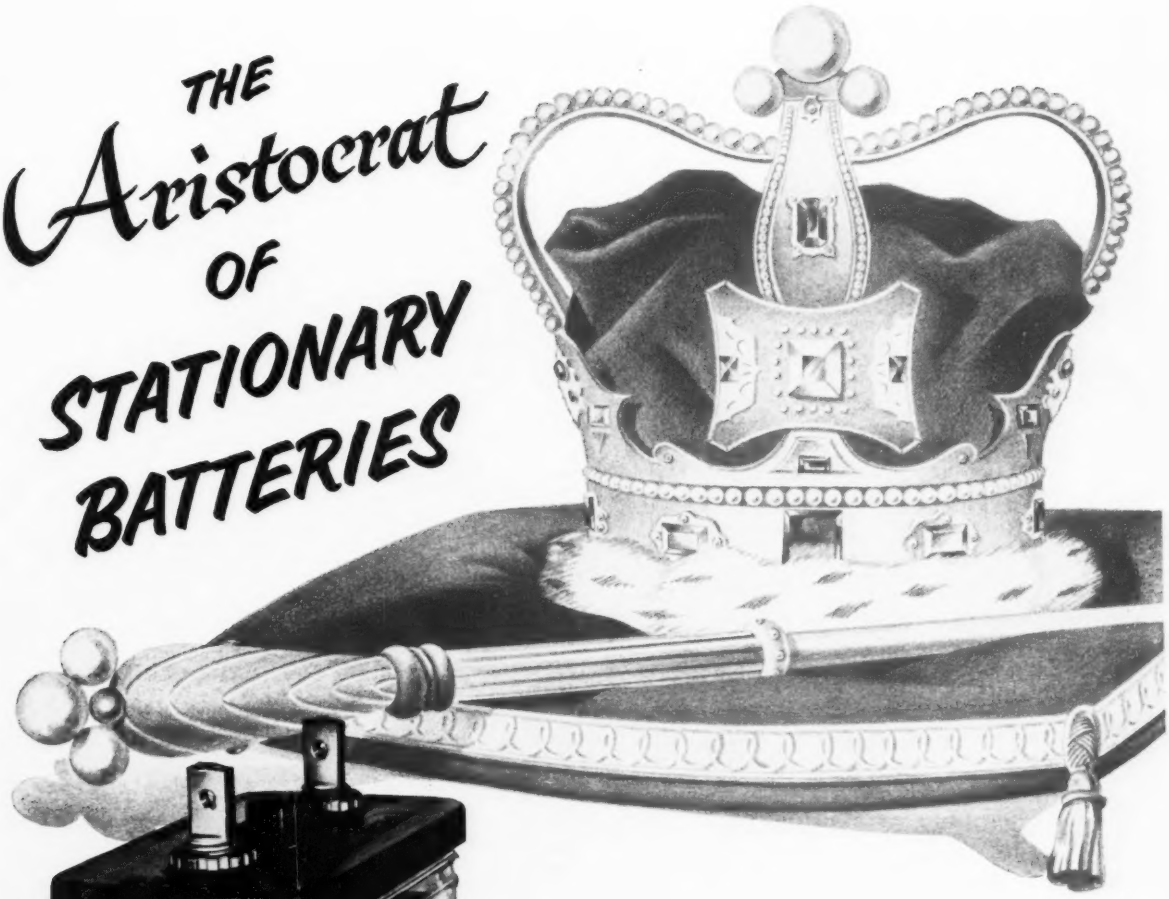
TELETYPEWRITER

MOBILE TELEPHONE

METERING CHANNELS

BELL TELEPHONE SYSTEM

THE Aristocrat OF STATIONARY BATTERIES



GOULD PLANTÉ is the finest battery money can buy! In switchgear, signal and alarm systems or emergency light and power applications, these batteries with the *pure lead* positive plates have rolled up such amazing service records that they have the lowest per annum cost of any battery on the market! For utmost dependability and economy, choose Gould Planté—the Aristocrat of Stationary Batteries.

You may be able to save up to 50% on maintenance costs throughout the life of your stationary batteries by using the Gould Plus-Performance Plan. Write Gould Battery Information Headquarters for full details.

GOULD *Industrial Batteries*

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

You use the world's best paint on jobs like this

Of the $65,000 spent to paint this great bridge, less than a third was the cost of the paint itself. That's why it is economical to use the best quality aluminum paint that adds extra years between repaintings.

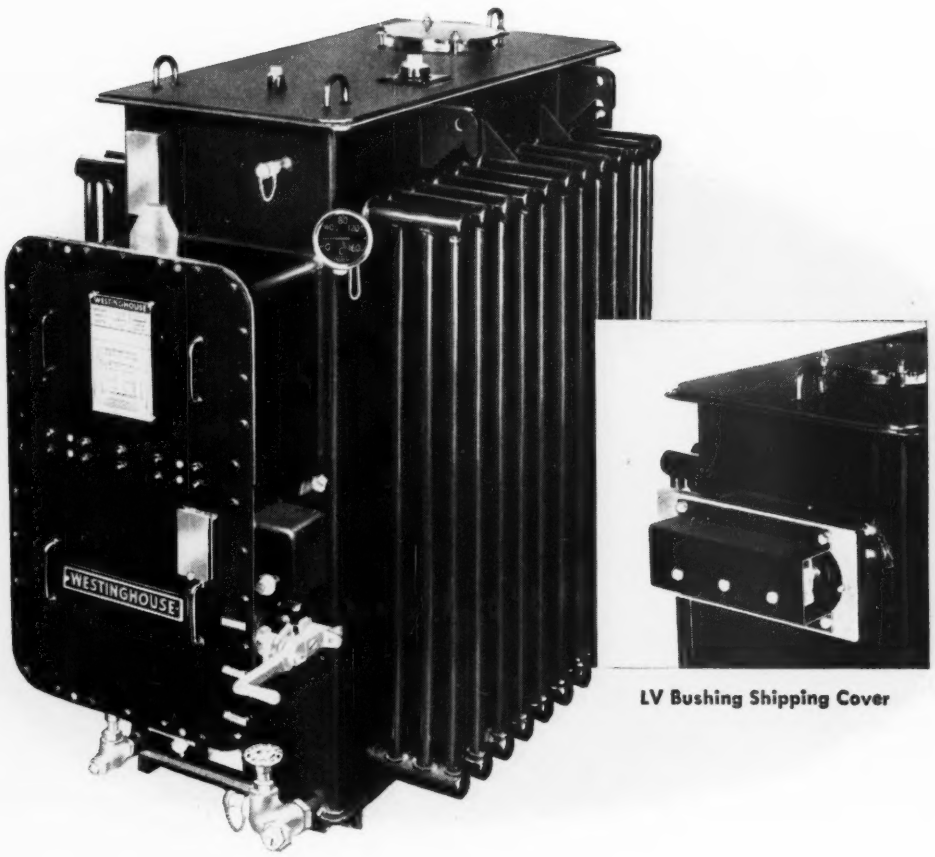
So much aluminum paint is used for metal and masonry surfaces that special formulas have been developed. Paints made to these formulas last longer, protect better under heat, cold, sun, rain, smoke and fumes.

If you have plants, structures or equipment that need paint, it will pay you to find out more about the kinds of aluminum paints now available. We do not make paint. But, as the leading suppliers of aluminum pigments to paint manufacturers, we want you to get the best results from the aluminum paint you buy.

Write us about your paint problems and we'll tell you what type of aluminum paint to use. We'll also send you a copy of *Painting with Aluminum*. It is packed with facts and answers to all types of industrial painting questions. Write Paint Service Bureau, Aluminum Company of America, 1787-B Alcoa Bldg., Pittsburgh 19, Pa.

Alcoa Aluminum

ALUMINUM COMPANY OF AMERICA



LV Bushing Shipping Cover

QUALITY in the transformer ADDS RELIABILITY to the network

Everyone agrees that when you install a network system, you install *the best* for reliability and service continuity.

But the degree of reliability...or, more exactly, the freedom from maintenance, depends directly on quality in the transformers.

That's why Westinghouse Network Transformers have continuously wound coils of sliverless copper, to guard against hot spots, crystallization and pricked or scored insulation. That's why they're high-frequency tested, too.

In addition, Westinghouse Transformers are filled under vacuum, and have welded-on covers to assure a perfect seal. Finishes are not only baked for longer life, but bases are undercoated.

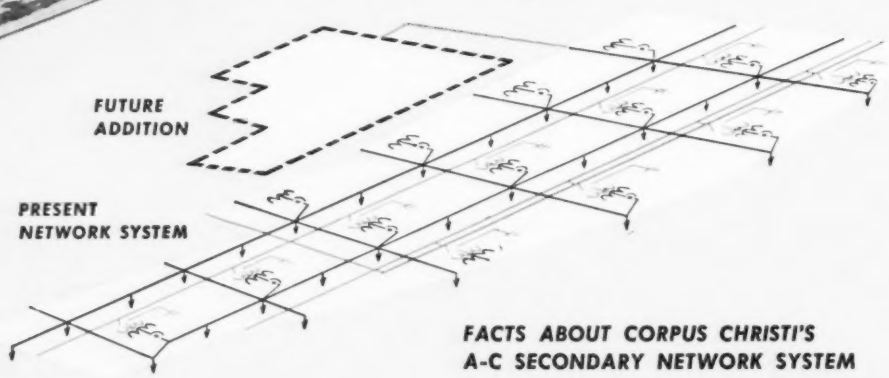
There are many other features such as the LV bushing shipping cover, shown above, that assure safe delivery of the quality built into Westinghouse Network Transformers. Your Westinghouse representative will be glad to give you full information, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70646

YOU CAN BE SURE...IF IT'S

Westinghouse

NETWORK TRANSFORMERS

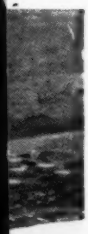
NETWORK SYSTEMS PAY... IN *Corpus Christi*



FACTS ABOUT CORPUS CHRISTI'S A-C SECONDARY NETWORK SYSTEM

The new network encompasses the area roughly below the Bluff from Mann Street to Born Street consisting of 43 blocks, (see large white area). The flexibility of the A-C Secondary Network System will permit the inclusion of 12 more blocks above the Bluff, (see dotted area). Thus far, the underground network system contains thirty-two subway-type network transformers and protectors and vaults.

Converting Growth Problems into Load Profits!



Rapid growth, including the construction of many new buildings and the addition of large loads such as air-conditioning units, brought the downtown overhead electric distribution system in Corpus Christi, Texas, to the practical limits of its expansion three years ago. Because of the unprecedented demand, the existing 2300-volt overhead radial system proved inadequate. There are no alleys in downtown Corpus Christi; streets were cluttered with poles and wires. In some cases, several sets of secondary mains were involved on the same street. Voltage regulation and service continuity problems were acute.

CAREFUL SYSTEM PLANNING by Central Power and Light Company indicated an underground network, supplied by a higher primary voltage, as the desirable long-term solution. In 1949 they embarked on a three-year program, installing a 12,480-volt primary. Four underground feeders were brought in from the Nueces Bay Power Plant to the new, downtown, A-C Secondary Network System. Because of tidewater conditions, this 43-block area presented serious construction and operation problems. The transformers are subway type, 500 kva, 3 phase, with throat-mounted submersible, 1600-ampere, 125/216-volt network protectors.

CENTRAL POWER AND LIGHT COMPANY now is able to provide customers with uninterrupted power supply . . . previous problems and unsightly pole lines have disappeared! The network system has proved as practical and economical as anticipated. In short, Corpus Christi has solved future load-growth problems . . . the utility now is ready to more economically serve its increasing load.

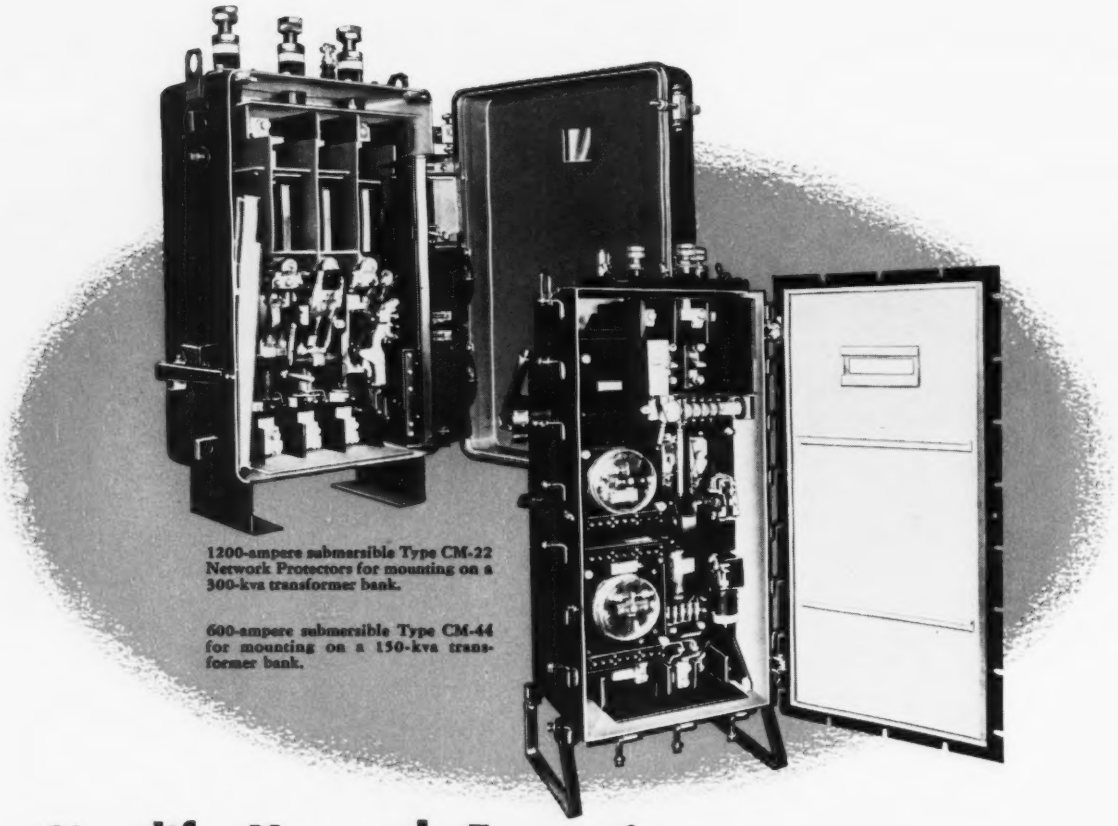
THE RANGE OF WESTINGHOUSE NETWORK EQUIPMENT enables you to employ the type of network system that best suits your future needs. Booklet B-4002, "A-C Secondary Network Systems", contains complete information about the flexibility and many advantages of this system. Our engineers are ready to help you in your network system planning. Call your nearby Westinghouse office, or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-97158

YOU CAN BE SURE...IF IT'S

Westinghouse

NETWORK EQUIPMENT



1200-ampere submersible Type CM-22 Network Protectors for mounting on a 300-kva transformer bank.

600-ampere submersible Type CM-44 for mounting on a 150-kva transformer bank.

Simplify Network Expansion with Westinghouse NETWORK PROTECTORS

You can expand your network system simply—and economically—with Westinghouse Network Protectors. The reason—Westinghouse heavy-duty and medium-duty protector use the same relays. Hence, as load grows medium-duty (CM-44) protectors can be replaced with heavy-duty (CM-22) protectors and suitable transformers—*without upsetting system co-ordination!* CM-44 units may then be moved to lighter load areas.

Keep this important Westinghouse feature in mind as YOU plan your network system. It's a *sure* way to provide for simple, low-cost expansion of that system when load conditions dictate.

Ask your Westinghouse representative for further information . . . or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-60778

ONLY WESTINGHOUSE NETWORK RELAYS . . .

- Eliminate gears that cause friction and wear.
- Have a sensitive reverse-current setting that can be varied from .1% to 10% of the network protector rating.
- Have bearing surfaces readily accessible for inspection and cleaning.
- Have relay terminal screws that eliminate the need for additional testing facilities in the control wiring.
- Provide a nonsensitive relay that permits sensitive tripping after a time-delay.

YOU CAN BE SURE... IF IT'S

Westinghouse

NETWORK PROTECTORS

CADWELD® LUGS OR YOUR
OWN FABRICATED BAR STOCK
PLUS
A
CADWELD®
CONNECTION
EQUALS
THE FINEST TERMINAL
CONNECTION ON THE MARKET
– 100% relative conductivity
– Cannot loosen or corrode
– Unequaled mechanical properties
– Installed with inexpensive lightweight equipment
The Answer to Design Problems and Special Applications
CATALOG ON REQUEST
ERICO PRODUCTS, INC.
2070 E. 61st Place • Cleveland 3, Ohio

DESIGNED

. . . with These Points in Mind!

Type MH-2P

DUNCAN

Type MH

POLYPHASE

METERS

Type MH-2S

CAPACITY

Elements mounted in the back of the meter allow shortest possible current coil leads—more capacity can be built in. All MH 50-ampere socket-type meters have adequate capacity for 200 amperes continuous load, when installed in mounting devices of comparable capacity.

SURGE RESISTANCE

The electromagnet insulation has been increased to provide twice the minimum acceptable safety factor. An Alnico damping magnet prevents calibration changes due to lightning surges.

ACCESSIBILITY

As with all Duncan meters, adjustments are accessible from the front. "Microset" action greatly reduces testing time. Meter discs are accessible for every type of testing.

APPEARANCE

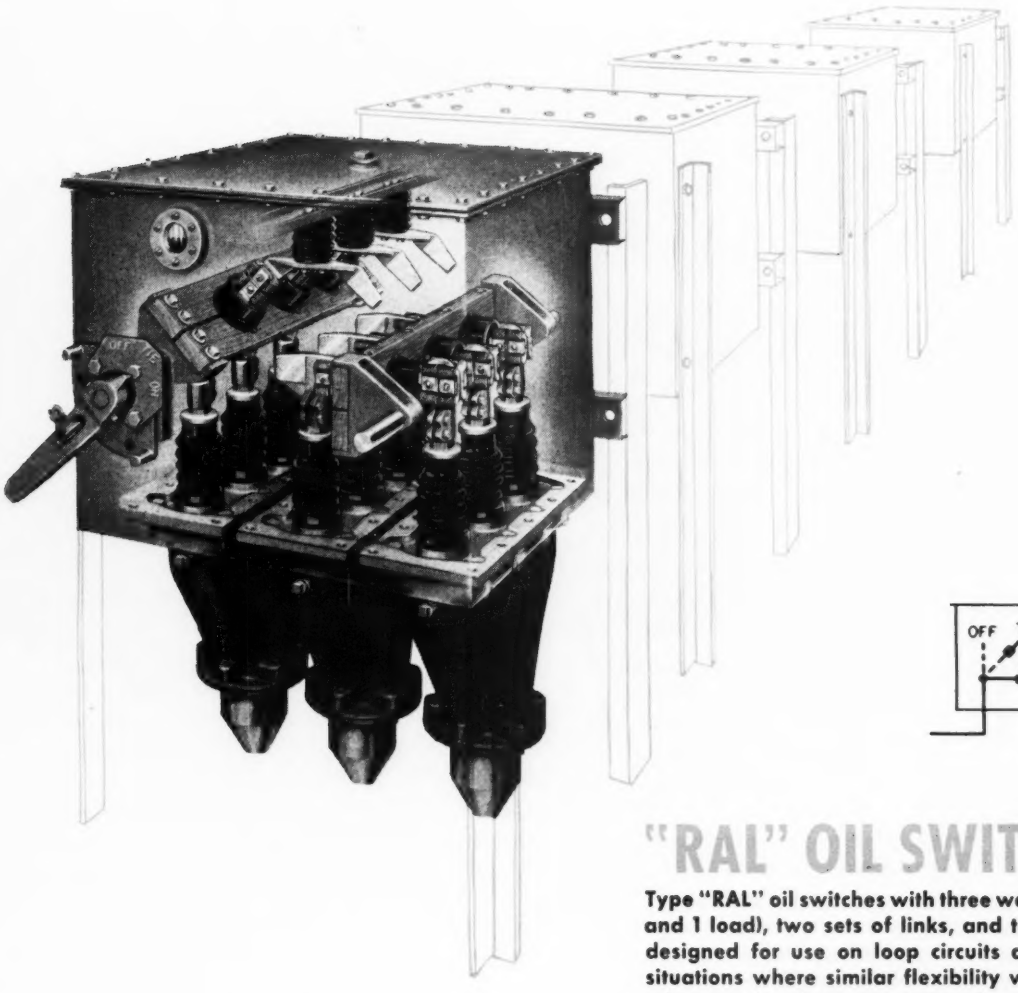
The Type MH polyphase meter is a meter of clean-cut design. A neat appearing "utility representative" on any customer's premises.

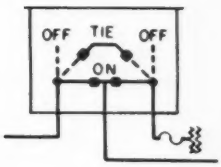
DUNCAN

makers of watthour meters for over fifty years

DUNCAN ELECTRIC MFG. CO. **LAFAYETTE, INDIANA**

PROVIDE SAFE SECTIONALIZATION FOR CABLE SYSTEM FLEXIBILITY WITH G & W LOAD BREAK OIL SWITCHES





"RAL" OIL SWITCHES

Type "RAL" oil switches with three ways (2 feeder and 1 load), two sets of links, and tie buses are designed for use on loop circuits and in other situations where similar flexibility would otherwise require three separate oil switches with correspondingly greater expense for equipment, installation, and space.

These oil switches materially reduce the length of time required for restoring service in case of trouble, or for isolating a circuit to make changes. Load break disconnection of a circuit is accomplished by manually operating an external lever —without opening the tank or breaking the oil and moisture seals.

Bulletin DB51 gives complete data and prices. Write for your copy or ask your representative.

G & W "Forethought" DB-20 shows how "RAL" switches are combined with power fuses. Send for your copy, there is no obligation.

G & W ELECTRIC SPECIALTY CO.

7780 Dante Avenue, Chicago 19, Illinois

Cable Terminating, Connecting and Sectionalizing Devices

Representatives in principal cities of U. S. A.

In Canada—Powerlite Devices, Ltd., Toronto and Montreal

UNIFORM LOW-PRESSURE,

That little bear has nothing to worry about. Powerful as his Mother is, those huge paws hold the small cub firmly, but with no dangerous pressure. He is fully protected from all natural dangers.

Neither will you have to worry about your conductors if Preformed Armor Rods* are used for (1) Repair Armor (2) Splices (3) Dead-Ends (4) Hot-splice Shunts and (5) SUPPORT ARMOR UNDER SUSPENSION CLAMPS, STOCK-BRIDGE DAMPER CLAMPS; HOT-LINE TAPS, SPLIT-BOLT CONNECTORS OR ANY OTHER CLAMPING DEVICE.

Preformed Armor Rods eliminate any possibility of concentrated high pressures that may cause cold flow of soft conductor metals. There can be no "locking or freezing" of conductor strands under the free ends of Preformed Armor Rods. Your conductor is efficiently protected against vibration fatigue; chafing, abrasion, arcing, slippage and LOOSENING of hardware accessories.

Preformed Armor Rods are the only means of obtaining the UNIFORM LOW-PRESSURE LARGE-AREA CONTACTS that are proving so important in lengthening the life of conductors, particularly aluminum.

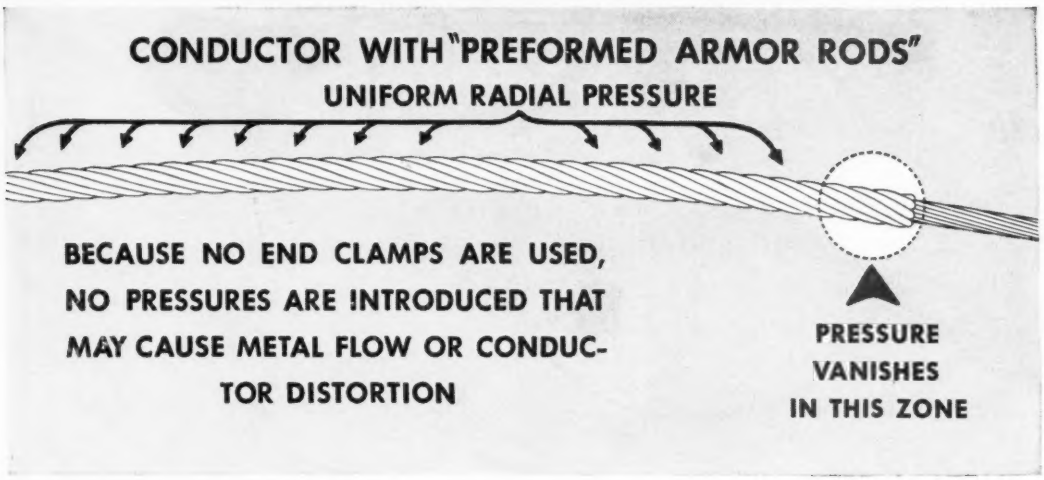
For an up-to-the-minute memorandum on this whole subject by Mr. T. F. Peterson, write Preformed Line Products Co., 5349 St. Clair Ave., Cleveland 3, O.

**Preformed Armor Rods are manufactured under Patent No's 2,275,019 and 2,587,521 . . . other patents pending.*

PLP

PREFORMED

LARGE-AREA CONTACTS
Eliminate Damaging High Pressures


CONDUCTOR WITH "PREFORMED ARMOR RODS"
UNIFORM RADIAL PRESSURE
BECAUSE NO END CLAMPS ARE USED, NO PRESSURES ARE INTRODUCED THAT MAY CAUSE METAL FLOW OR CONDUCTOR DISTORTION
PRESSURE VANISHES IN THIS ZONE

IN ADDITION:

1 Lower suspension clamp temperatures are assured because Preformed Armor Rods add extra metal to the conductor within the suspension clamp. The greater electrical conductivity naturally reduces I^2R losses.

2 Preformed Armor Rods never loosen. Made of high-strength, spring-quality metals, these rods are elastically sprung onto the conductor. This principle has also been incorporated into PLP Dead-Ends and splices.

3 Conductor chafing is practically eliminated because vibration presses are distributed more evenly. What little abrasion occurs, takes place on the tough armor rods rather than on the soft conductor.

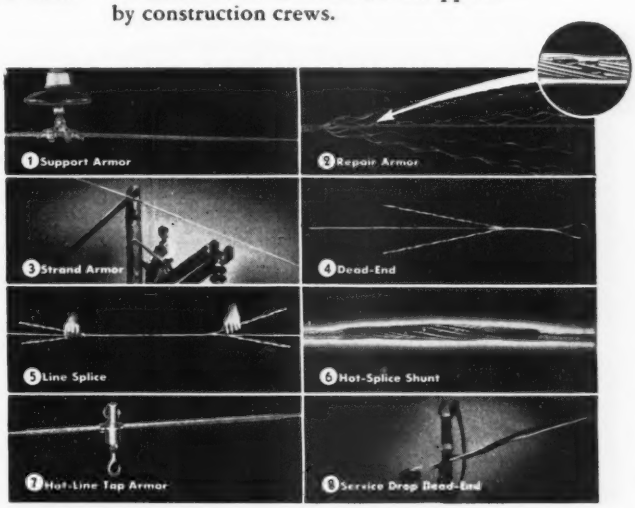
4 Factory control of Preformed Armor Rod dimensions guarantee uniformity of field installations. The rods are "factory-fitted" for the particular conductor and cannot be misapplied by construction crews.

There is no question that ALUMINUM CONDUCTORS are here to stay. BUT, connecting and supporting ALUMINUM CONDUCTORS to assure maximum life require new types of clamp supports, splices, dead-ends, tap connections and service-drops.

The efficient and economical answers to these problems . . . not only for Aluminum Conductors, but also for ALL TYPES OF CONDUCTORS . . . are the PLP products shown here.

For details of their exclusive advantages, write or . . .

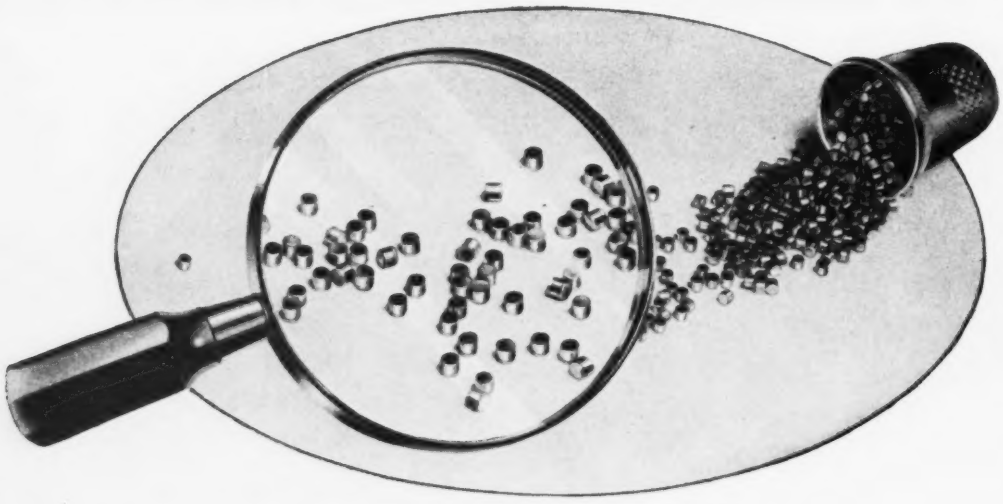
TELEPHONE CLEVELAND: EXpress 1-3571



LINE PRODUCTS CO.

5349 ST. CLAIR AVENUE
CLEVELAND 3, OHIO

Millions of Cycles of Contact Life...



At One-Third the Cost

Nearly a thousand of these contacts will fit in a thimble, yet the accuracy of a gasoline gauge depends on their uniform performance over a life measured in millions of cycles.

The instrument is designed so that the varying width of the contact gap controls the gauge. As a result, the contact gap is extremely critical. Once the gauge is calibrated, the contacts must retain their shape precisely. They have to resist the peening effect of high frequency operation. They must withstand the pitting and erosion of almost continuous arcing and still maintain low contact resistance with light pressure.

For this kind of an application, platinum and platinum alloys would seem to be the logical choice. There is just one drawback . . . the cost. This is where Mallory's experience in contact engineering was able to save the manufacturer two-thirds of his previous cost.

Through metallurgical techniques, Mallory creates new materials by combining the desirable characteristics of several metals. One of these materials is Elkonium 17, a silver-nickel-cadmium alloy which had the required characteristics . . . at a fraction of the cost.

Other Mallory contact materials will meet the requirements of virtually any electrical contact application. Whether your problem involves simple button or rivet contacts—or a complex assembly—take advantage of the experience our engineers have accumulated in the development of over 5000 different types of contacts and contact assemblies. Call us today . . . lower your production costs tomorrow.

Expect more...
Get more from **MALLORY**

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

Electrical Contacts and Contact Assemblies

P.R. MALLORY & CO. Inc.
MALLORY

SERVING INDUSTRY WITH THESE PRODUCTS:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Dry Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO., INC., INDIANAPOLIS 6, INDIANA

Day in--Day out DEPENDABILITY...

Year in--Year out ECONOMY...

HAZARD WATERTITE-HAZAPRENE® CONTROL CABLES

Assurance of day in and day out maintenance-free performance makes Hazard Watertite-Hazaprene cable construction ideal for control circuits. From the inside out — from the corrosion-resistant Hazaloy coated conductors to the rugged Hazaprene sheath — Hazard Watertite-Hazaprene is engineered for long-lived economy.

Watertite-Hazaprene amply meets the exacting requirements of control cable service. Rubber fillers prevent the wicking-in of moisture . . . firm, electrically strong, long-lived Watertite rubber insulation prevents deformation . . . the tire-tough Hazaprene ZBF sheath offers superior resistance to flame, oil, acid, alkali, sunlight, moisture and mechanical damage. The ZBF sheath is a research-developed, service-tested protective covering, compounded of neoprene to Hazard's special Zinc Borate Formula; it is pressure-vulcanized in a continuous lead sheath to give a smooth, dense surface that resists abrasion and tearing.

There's a Watertite-Hazaprene Cable for every control circuit requirement. For further information about these dependable, money-saving control cables, write to Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

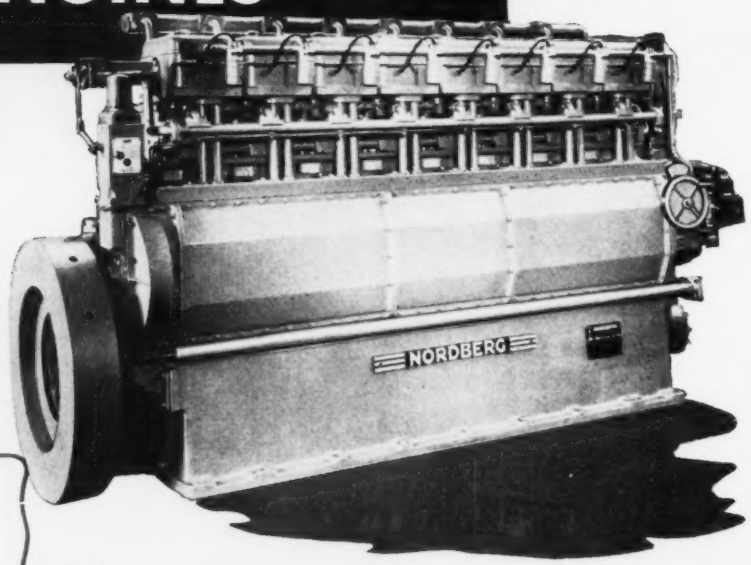
NOW . . . SUPAIRTHERMAL*

SPARK-FIRED

GAS ENGINES

*Trade mark

. . . another NORDBERG achievement for outstanding GAS FUEL ECONOMY in a WIDE RANGE of HORSEPOWER



Ten IMPORTANT FEATURES

1. *High thermal efficiency.*
2. *Proven ignition systems.*
3. *Same heavy-duty construction features as Nordberg 4-cycle Diesel engines.*
4. *Double the horsepower of naturally aspirated engines.*
5. *Smooth, uniform combustion.*
6. *Lower exhaust temperatures.*
7. *Convertible to Diesel or DUAFUEL® operation.*
8. *More horsepower hours per gallon of lubricating oil.*
9. *Wide range of horsepower.*
10. *Wide speed range.*

NORDBERG 4-cycle spark-fired gas engines, in sizes from 265 to 4260 H. P., now fill a long desired need for a highly efficient prime mover in industrial and municipal service. Increasing gas fuel costs have made *economy* the "watchword" of power plant operation. Nordberg *SUPAIRTHERMAL* spark-fired gas engines have a thermal efficiency in excess of 40 per cent as compared to 30 per cent or less in conventional non-supercharged engines.

Substantial savings in fuel costs and lower installation costs result through use of Nordberg gas engines. When capitalized over a period of years, they will more than pay for the original investment.

If you are looking for ways to cut power costs, get the full story on this latest Nordberg achievement . . . the result of sixty years' experience in the design and construction of prime movers and heavy machinery.

NORDBERG MFG. CO., Milwaukee, Wisconsin

For complete details about Nordberg Spark-Fired Gas Engines, write for a copy of the new BULLETIN 221.

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

NORDBERG MACHINERY

Builders of America's Largest Line of Heavy-Duty Diesels

P253

Reliable Operation and Constant Timing ... from Mechanically Stored Energy

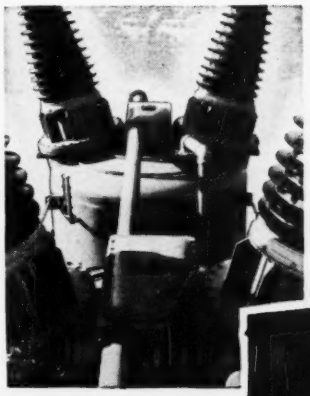
115- to 230-kv 3-cycle
(Also other styles, 7.5 kv and up)

PACIFIC ELECTRIC Type RHE

HIGH-SPEED RECLOSING

CIRCUIT BREAKERS

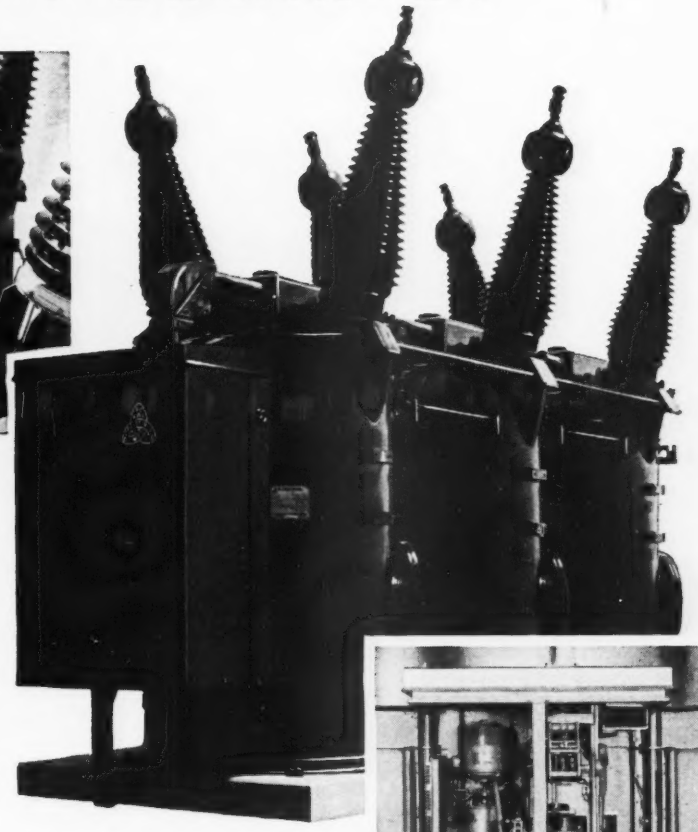
to 10,000,000 Interrupting kva at 161 or 230 kv

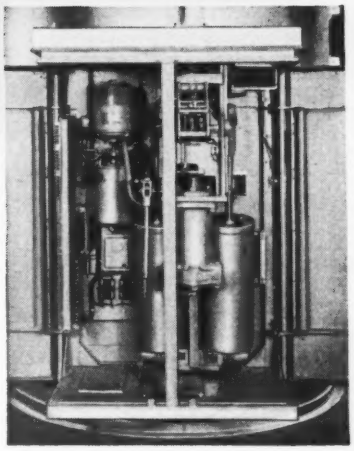


RIGHT: View of Tank Tops, looking toward Tank No. 1, showing housings for opening springs and tube containing pull rod.

CENTER: Type RHE in TEXAS (138 kv).

FAR RIGHT: Interior of Mechanism Cabinet, showing both closing-spring barrels and motor-operated oil-hydraulic jack for spring compression.





THE MOTOR-Compressed operating springs of the PACIFIC Type RHE oil circuit breaker stand ready for action for years, if necessary, without anything meanwhile having to move or operate.

Directly connected to the crank arm of the blade unit in each tank is a set of external opening springs. In the end-mounted mechanism cabinet are the closing springs which act upon the pole units through a pull rod that is compensated for unequal stretch in its sections. Simultaneous operation is thereby assured at all poles.

Energy is stored in the closing springs by means of a motor-operated oil-hydraulic jack. Oil is under pressure only during the ten-second interval required for compression of the springs.

These features insure reliability of operation as well as constant closing time under all conditions . . . of special benefit when synchronizing.

Write for Catalog 585

PACIFIC ELECTRIC • MFG. CORPORATION •

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA
OTHER FACTORIES: SANTA CLARA, CALIFORNIA; GARY, INDIANA

Since 1906

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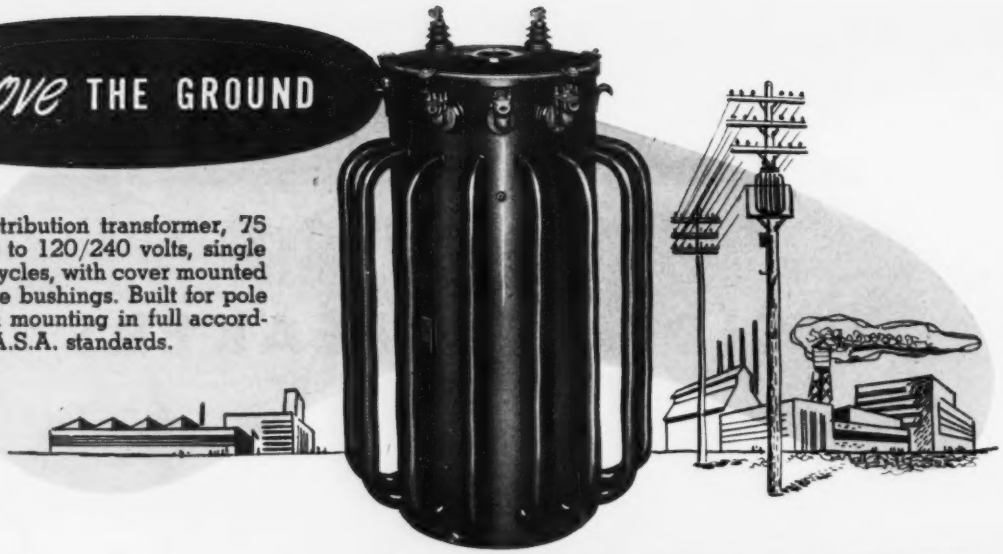
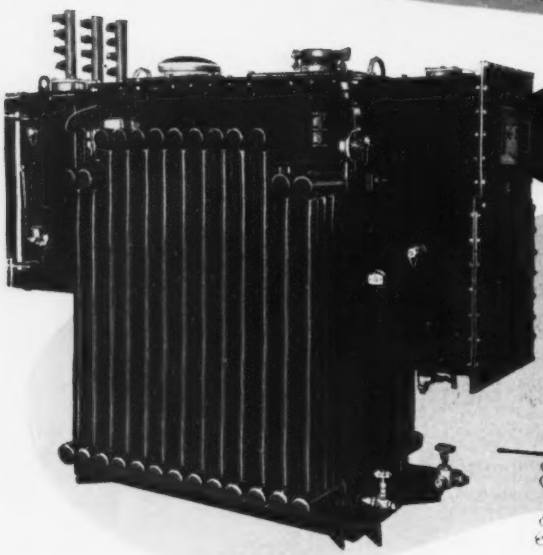
Above THE GROUND

Type A distribution transformer, 75 KVA, 2400 to 120/240 volts, single phase, 60 cycles, with cover mounted high voltage bushings. Built for pole or crossarm mounting in full accordance with A.S.A. standards.



Standard

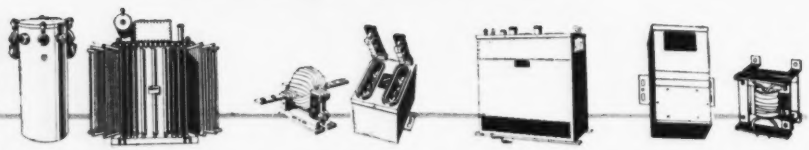
TRADE MARK



Under THE GROUND

Type HTS Askarel subway type network transformer, 500 KVA, 12,470 to 216Y/125 volts, 3 phase, 60 cycles, complete with high voltage disconnect and grounding switch, low voltage network protector, and electrical interlocks.

Transformers FOR EVERY APPLICATION



Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)

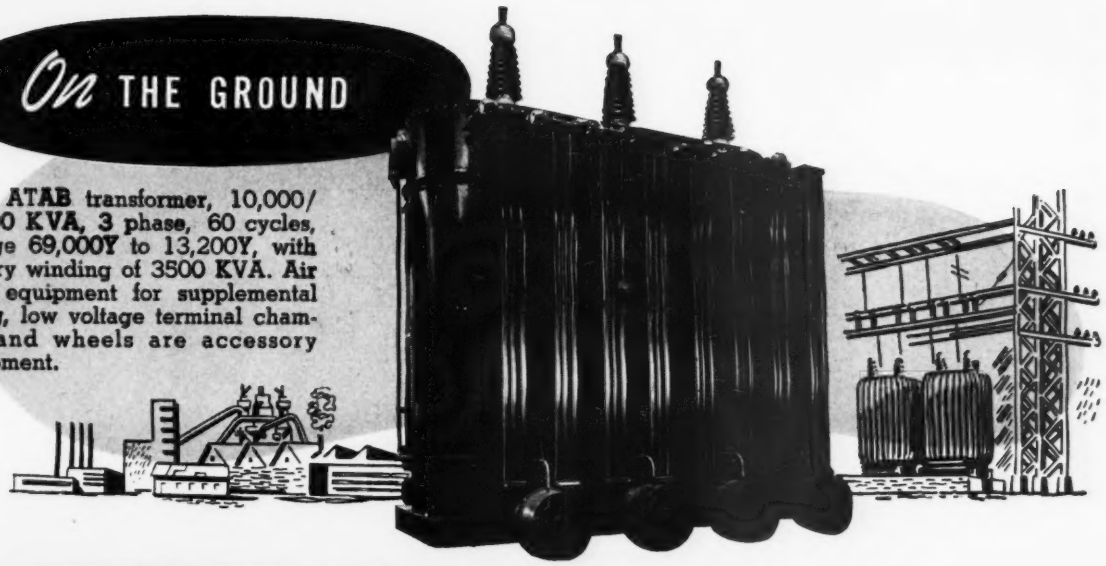
Instrument transformers (for use on circuits up to 72,000 volts, inc.)

Dry type (up to 1000 KVA and max. voltage ratings of 4800.)

Control transformers (compound filled or open type.)

On THE GROUND

Type **ATAB** transformer, 10,000/12,500 **KVA**, 3 phase, 60 cycles, voltage 69,000Y to 13,200Y, with tertiary winding of 3500 **KVA**. Air blast equipment for supplemental rating, low voltage terminal chamber and wheels are accessory equipment.



TRANSFORMERS AT EVERY LEVEL

Installed on thousands of poles throughout the electrical distribution system. On the ground stepping-up or stepping-down at substations. Underground at network load centers. You find STANDARD transformers operating at every level because . . .

. . . users of electrical equipment, having learned through actual experience, place their confidence in the transformers that are built "right" from the ground up. Designed by topflight engineers, constructed by craftsmen who know the importance of following instructions to the letter, then . . .

. . . tested by STANDARD, a recognized leader in the manufacture of Testing transformers. Thus possible future trouble spots are located and eliminated before the transformer leaves the factory. Fully protected from the ravages of dust, dirt, fumes and dampness. Rugged construction allows STANDARD transformers to be used anywhere. Next time remember . . . STANDARD TRANSFORMERS.

Standard

The Standard Transformer Co.

Warren, Ohio

Representatives in principal cities

From time card to travel ticket

Every angle completely covered . . . but one! When fire strikes during the night your skilled labor may go in the morning. The fully experienced Joes, Bills and Toms can't stand the financial strain of waiting . . . their time cards can become travel tickets to new jobs, while you're struggling to replace the ravages of fire.

The threat of losing your skilled labor due to an unexpected fire tragedy can be fully eliminated. With C-O-TWO Smoke or Heat Fire Detecting Systems plus C-O-TWO High Pressure or Low Pressure Carbon Dioxide Type Fire Extinguishing Systems your plant can have fast, positive, round-the-clock fire watchman service simultaneously at each fire hazard point.

At locations where a deep-seated, smoldering internal fire as well as a fast burning external fire might occur, the smoke detector of a C-O-TWO Smoke Fire Detecting System, based on an exclusive operating principle, automatically detects the first trace of smoke, smoldering or fire.

For locations where excessive heat or combustion might cause a flash fire, the heat detectors of a C-O-TWO Heat Fire Detecting System automatically sound a warning at the first flash of fire.

Then clean, dry, non-conducting, non-damaging carbon dioxide is instantly released from either a C-O-TWO High Pressure or Low Pressure Carbon Dioxide Type Fire Extinguishing System into the threatened area. The fire is out in seconds with little if any interruption to operations and the carbon dioxide disappears without a trace . . . one of the safest fire extinguishing agents known . . . harmless to equipment, materials and finishes.

WHEN BUSINESS STOPS . . . INCOME STOPS!

Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today . . . our extensive experience over the years is at your disposal without obligation. Get the facts now!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
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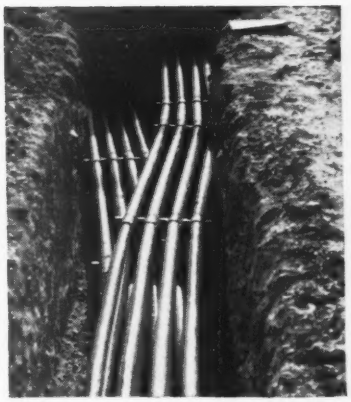
ORANGEBURG QUALITY FEATURES

Orangeburg Fibre Conduit is non-metallic — does not corrode. Lasts indefinitely. Impermeable walls and tight joints keep out corrosive ground waters. Smooth bore and low coefficent of friction protect cables from sheath abrasion. Resists acids, alkalis, salt, grease, oil. Tough, resilient. Lays faster at lower cost than any other type of conduit.



STANDARD *is installed with concrete encasement. Preferred for banks of three or more ducts.*

NOCRETE *is installed without concrete encasement. Extra heavy wall for direct burial—practical for many single or double duct runs.*

Utility Engineer's Standby For 60 Years

Leading public utilities and municipalities have used Orangeburg Fibre Conduit extensively for years. It's helpful to know why. The *long-term* protection that Orangeburg gives to cables underground helps the Electrical Industry to keep the *power flowing*—and *saves money* by prolonging cable life. Orangeburg also saves money in every phase of installation. The *standard fittings* supplied for *Orangeburg Conduit* likewise cut down costs by *simplifying installation.* Send to Dpt. EW-2 for complete catalog. Orangeburg Manufacturing Co., Inc., Orangeburg, New York.

ORANGEBURG® **STANDARD** WITH CONCRETE
NOCRETE WITHOUT CONCRETE

FIBRE CONDUIT

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DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

BRANCHES AND STOCKS IN PRINCIPAL CITIES

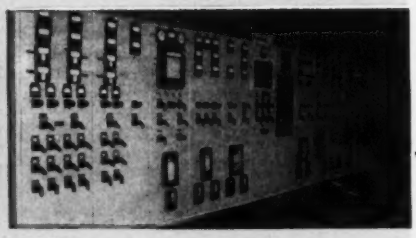
GENERAL ELECTRIC SUPPLY COMPANY

A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION

ALLIS-CHALMERS

MERCURY ARC RECTIFIERS

1. Two of these Allis-Chalmers outdoor oil circuit breakers guard the power entrance to the plant and two more serve as tie breakers. Each breaker is rated 3 cycle, 1200 amps, 161 kv, 7,500,000-kva interrupting capacity.



2. Duplex, tunnel-type main control board is located in rectifier room. It meters and controls all equipment in plant — from the 161-kv oil circuit breakers down to the mercury arc rectifiers and plant power substations.

For Non-Stop DC Power

It's Allis-Chalmers from 154-Kv Lines to Rectifiers in New Defense Plant

UNINTERRUPTED POWER is indispensable in the production of high purity chlorine and caustic soda in two mercury-type cell lines at the new Government-owned, Monsanto-operated plant at Sheffield, Alabama. To help meet this requirement, Allis-Chalmers supplied all of the switching, transforming and rectifying equipment.

Here's How Power Reaches Rectifiers

Under the guardianship of Allis-Chalmers 7,500,000-kva breakers, the 154-kv transmission voltage is stepped down to 13.8 kv by two transformers — each equipped for forced cooling so that either can supply the plant in an emergency.

Backed up by 1,000,000-kva breakers, the main 13.8-kv switchgear splits the electrical system into two plant power and two rectifier power sections — with bus-tie and other special provisions for reliability.

Final distribution for each plant power section is made by unit substations. Each rectifier power section goes through regulating and phase-shifting transformers and six rectifier transformers. The power is then carried through high-speed anode breakers to the 12-tube rectifier assemblies.

Incorporating many exclusive Allis-Chalmers features, the rectifiers operate in two banks of six assemblies each, to supply the two 30,000-amp cell lines.

A-C Engineering Can Serve You

For a complete rectifier plant or a single factory-packaged rectifier unit, you gain by calling in your A-C representative or writing to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3875

WITH ALLIS-CHALMERS *EXCITRON* RECTIFIERS

You Get These 10 Mercury Arc Rectifier Advantages

- Compact and light weight — need no special foundation.
- Push-button starting with no synchronizing.
- High power factor (lagging).
- Low idling loss and high conversion efficiency.
- High momentary overload capacity.
- Immunity to frequent short circuits.
- No major moving parts—provides low maintenance and assures quiet operation.
- No attendance needed during operation.
- Resistant to dust, moisture, fumes.
- Simple construction for long life.

PLUS These 6 Exclusive Allis-Chalmers Features

Fixed excitation anode — doesn't contact mercury and is independent of level, turbulence or impurities . . . requires no adjustment, maintenance or replacement.

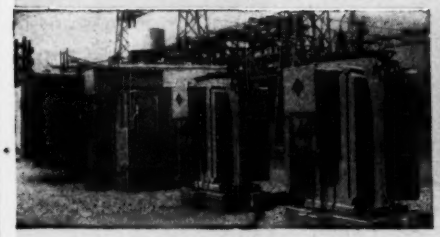
Continuous excitation — pilot arc always present. Eliminates need for continuous, synchronized re-ignition. Enables rectifier to ride through severe ac voltage disturbances.

Grid phase control — in cleaner region near anode, where ion density is lowest.

Internal cooling system — high heat transfer with seamless-tube cooling coil located within the rectifier.

Arc-over free tube — insulating entire arc path eliminates danger of arcing-over to tube.

Enamelled anode seals — multi-layer fused vitreous construction provides high-strength seal unaffected by thermal variation.



3. Regulated power for each six assembly rectifier bank is obtained from an auto-regulating transformer (left) supplemented by a 32-step regulator. Two phase shifters (right) are also used for each bank of rectifiers.

4. Rectifier transformers are alternately connected wye and delta. This arrangement plus phase shifters results in each six-transformer bank providing a 36-phase system that minimizes communication circuit interference.

5. Rectifier room, containing twelve 6000-amp, 600-volt, 12-tube, *Excitron*-type rectifiers. Each is a factory-assembled unit, complete with built-on evacuating apparatus, water-to-water heat exchanger, and water circulating, control and protective equipment. (See list at left for six ***exclusive features*** of Allis-Chalmers *Excitron* rectifiers.) In picture above at left are the anode breakers; at right, the cathode breakers with disconnect switches; and in the center, the excitation compartments containing excitation, phase control, vacuum measuring, and protective equipment.

ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry

KERITE
CABLE-GRAM

THE PLUS VALUES OF A PRODUCT WELL DESIGNED AND BUILT FOR LONG SERVICE WILL OUTLAST YOUR MEMORY OF THE DAY YOU BOUGHT IT BUT WILL NEVER OUTLAST YOUR APPRECIATION OF ITS WORTHINESS.

THE VALUE AND SERVICE LIFE OF A PRODUCT CAN BE NO GREATER THAN THE INTEGRITY AND CRAFTSMANSHIP OF ITS MAKER.

DAYS KERITE

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.

Accelerated Amortization

One of the most pressing and important problems facing the electric utility industry today is the regulatory treatment of accelerated amortization. To date, some $3.6 billion of facilities have been processed as belonging to the "defense group." Approximately 45%, or $1.6 billion, has been certified for accelerated amortization over a five year period. Assuming an average depreciation rate of 3% per annum for tax purposes, the annual additional income over and above the normal will amount to $140 million per annum over the next five years. Conditions will naturally vary considerably from one utility to another, depending on the amount and percentage of property certified. But on an overall basis, if the above amount were to flow through to surplus, net income of the private utilities for 1952 could be increased by approximately 15%. This assumes that the companies avail themselves of the full amount of the certifications.

It would appear that Congressional intent is clear in that the benefits of the tax deferral belong to the investors of the industry. It is they who are underwriting the risks of the defense expansion. Consequently, any equalization in either book or rate base accounting will abrogate the intent of Congress with regard to the benefits accruing to industry by virtue of the tax deferral. Such treatment will have a material effect on the future financial position of the utilities.

Until recently, a substantial majority of orders by regulatory commissions required the use of the appropriated surplus in normalizing savings arising from federal income tax deferrals. However, an important development of far reaching consequences for the utility industry took place when the Georgia Commission, on Dec. 23, 1952, issued its order with respect to the Georgia Power Co. It prescribed equalization for both financial and rate base purposes. Thus no relief is allowed for the greater risk assumed by the stockholder.

The Federal Power Commission has ordered hearings on March 11 of all interested parties with respect to the treatment of accelerated amortization both as regards its accounting and rate making aspects. The fundamental problems which the industry might present to the FPC are:

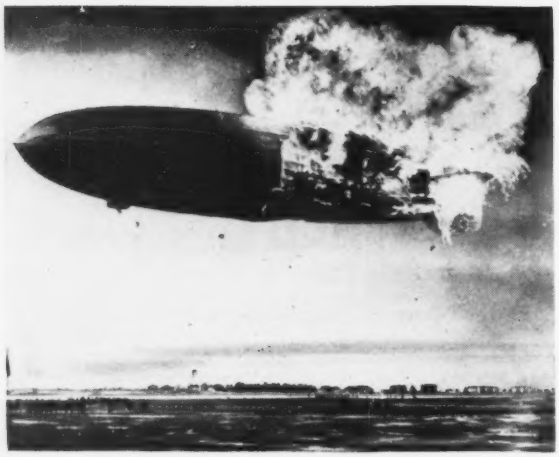
1. Whether the intent of Congress is not abrogated by the imposition of arbitrary accounting treatment prescribed by the commissions.

2. Whether, if accounting treatment is prescribed, such treatment should bear any relationship to the determination of both rate bases and rates of return.

3. Whether the benefits of the so-called interest free loan (tax savings) accrue to the ratepayer or to the stockholders and whether or not gross discrimination might result between rate payers themselves.

It may be significant that the commission in the recent Texas Eastern settlement said that if the company availed itself of its amortization privileges then the commission may order the company to refund to its customers the amount of such savings over the period of amortization.

Sixteen state commissions have already issued 22 orders prescribing accounting treatment for accelerated amortization. But it is still important to assure a favorable FPC decision on this important problem.



You Should Be There

This dramatic picture of the destruction of the German zeppelin, "Hindenburg," may bring back memories of the great disaster at Lakehurst, N. J., in 1937. It may also bring back memories of a television show of Feb. 1.

This was the first of a series being sponsored by the Electric Companies Advertising Program. Forty-one CBS-TV stations are carrying the series, 15 as a live show at 6 PM (EST), on alternate Sundays beginning Feb. 1, the others as delayed shows at various times. Lined up for March 1 is "The Trial of Joan of Arc" and for March 15, "The Defense of the Alamo." The show will be presented unsponsored in the alternate weeks.

Entitled, "You Are There," the show is a TV adaptation of the radio program of the same name. Well-known actors and actresses will portray the parts of the principals in the various historical events they will reenact. Walter Cronkite, CBS-TV chief Washington correspondent, heads the news staff that makes news of the past the news of today.

Sponsorship of this program will enhance the prestige not only of ECAP but of all the industry. All electric companies should lose no opportunity to call it to the attention of their stockholders, employees, and customers. When this show can be seen on your TV set, you should be there.

NRECA Resolves That TVA Is Different

"But it is different in the case of TVA." With this remark one manager of a rural electric cooperative sought to justify two of 55 resolutions passed without significant opposition by the National Rural Electric Cooperative Association in recent assembly at San Francisco.

Resolution 19 requested that continued appropriations be made by the Congress to "supplement, advance, and continue" the Tennessee Valley Authority as a "great development of our national resources." But Resolution 22 urged the Congress to "support legislation to protect and defend the right and opportunity of the cooperatives to construct and operate generating plants and transmission lines and to appropriate adequate funds for this purpose."

In passing these two resolutions, the cooperatives find themselves in the position of condoning a utility operation which by law, or the absence of law, is diametrically opposite to the prinicple they feel is necessary for their very existence. Under the act which created TVA its customers have little say regarding their power supply, either individually or through cooperative effort.

Fortunately for most cooperatives this is not the case. There have been instances where a rural system thought the rates were too high or service unsatisfactory and has appealed to the regulatory commission or to the courts. In some cases, however, cooperatives have used the threat of building their own generating and transmission facilities to effect a rate reduction. Electrical World deplores the fact that such a threat has been the last recourse. Such action promotes ill feeling between the cooperative and its supplier and makes only more difficult the establishment of an understanding and cooperative attitude which is necessary if both parties are to keep up with ever-expanding demand.

However, Electrical World hopes that all members of NRECA will give further and thorough study to such contradictions as Resolutions 19 and 22. These include all other attempts by NRECA's leaders to associate individual members with the public power movement and win their support for public power schemes which on the surface "give the benefits of our nation's natural resources to all the people." Otherwise it may turn out for all the electric utility industry—private power companies, rural electric cooperatives, and municipal systems included—that it isn't different in the case of TVA.

A Utility Promotes Visioneering

A new kind of engineer has made his appearance on the staff of Pennsylvania Power & Light Co. He is a visioneer, an engineer for vision (See page 100). Officially no one on the PP&L staff yet bears that title. But it should go to Paul Hildebrand, the company's lighting director, who created the name and under whose direction the company is laying down the broad principles and functions of the new profession.

The true visioneer is the lighting engineer one degree advanced. His work for many years most likely will be in the industrial field where there is the greatest need for his services. Visioneering adds to the selling of industrial lighting two concepts: 1. That proper lighting equipment gives the best results when it is installed in a place painted in the proper colors. 2. That the best lighting equipment and the best painting job have little value if the employees have defective eyesight.

It is the second concept that will startle the industry because PP&L has taken the attitude that it is its duty to aid industrial customers in improving the eyesight of their employees. The company has purchased a visual screening instrument which it will lend to any customer without charge if the customer will pay a registered operator $1 for each employee whose eyes are tested.

With the little already done the utility can already report the enthusiastic support of the optometrists and others providing eye care. National paint companies are eager to cooperate. It is believed that the workers also will welcome a free eye test and any improvement in lighting conditions which may result. And the industrialist who must pay the bills can look forward to greater profit because of increased output, fewer defective parts, and better employee relations.

Utilities should lose no time in studying the advantages visioneering may offer them.

THE ELECTRICAL WEEK

The Issue's News Highlights—Truman-appointed Missouri Basin Survey Commission makes recommendations for organizing and directing water resources development program in the Missouri Valley.

Pacific P&L Pres Paul B. McKee heads MSA mission to Belgium and the Netherlands to evaluate U. S. aid programs for NATO allies.

Some big decisions lay ahead for Interior Secretary McKay. Among them are whether civil works functions of Army Engineers should be transferred to Reclamation, who should build Hells Canyon project, and whether Interior should accept Georgia Power's transmission offer.

Off the Washington Wire—Iowa PS asks FPC approval to buy 55 miles of 161-kv transmission line to be built by Kansas City P&L from Fort Dodge to a point about 6 miles north of Iowa Falls for $990,000.

Giving effect to the Administration's economy order, Interior now requires Washington clearance of all contracts amounting to more than $10,000. Agencies affected include Reclamation, BPA, SEPA, and SPA . . . Office of Defense Mobilization may ask FPC to disregard issuance of fast tax amortization certificates in fixing utility rates. Argument would be that fast amortization was approved by Congress as an incentive for utilities to step up expansion for defense needs, and rates geared to actual tax paid would nullify this incentive.

Second round of hearings were underway last week before FPC on bringing natural gas to Pacific Northwest. Argument centers around whether the gas would come from the Southwest or from Canada.

From New England—Eastern Utilities Associates, holding group operating in New England, notes improved industrial power revenues reflecting better production in textile industry. New peak demand of 205,700 kw has been reached at a level 8.8% above previous maximum.

Massachusetts Gov Christian A. Herter halts strike at Boston Edison Co by invoking the Slichter Act which enables the state to seize industries when a work stoppage would endanger public health or safety.

Construction begins on 110-kv transmission line from Framingham to Waltham, Mass., the final link in a high-tension ring connecting Boston Edison's Edgar and Mystic stations. Work on the line had been delayed several years by litigation, seeking, among other objectives, to force underground construction. Recently the issue was decided in company's favor.

Electric operations in Malden and Revere, Mass., are to be merged into Suburban Electric Co, while those of Salem, Beverly, and Gloucester electric utilities are scheduled, after regulatory approval, to be merged into Essex County Electric Co. They are all subsidiaries of the New England Electric System. Gas operations are being divorced from electric.

From the Southeast—Appalachian Electric Power gets West Virginia PSC approval to buy distribution system in Fayette and Raleigh counties from New River Co . . . Florida P&L will spend $33 million for expansion in '53.

Pennsylvania Legislation—House bills 157 and 158 are introduced providing for public election of PUC members; House bill 61, prohibits increases in rates by utilities without a public hearing; House bill 53 gives PUC power to regulate rates for utility service furnished by municipal authorities.

Rates—Washington Water Power gets Idaho PUC approval to increase rates by $233,249 a year on bills rendered on and after Feb. 9 . . . Pennsylvania PUC orders West Penn Power to cut rates $1,663,840 a year and make refunds covering the last 17 months to customers . . . Maine Supreme Court orders the state commission to grant a $2.6 million a year intrastate rate increase to New England Telephone & Telegraph, declaring that a rate base fixed on fair value must be the criterion rather than prudent investment . . . Missouri PSC sets hearing on April 27 for Union Electric's application to increase rates by $5.4 million a year . . . Kentucky PSC is now taking under consideration for rehearing Union Light, Heat & Power's petition to up rates $935,000 a year. This petition had been previously denied by PSC.

Federal Electric Products Co has an option to purchase the outstanding stock of Pacific Electric Manufacturing Corp.

Niagara Mohawk Power Corp gets New York PSC approval of an electric franchise granted by Town of Morehouse, only township in New York without any electric service.

A definite shifting of population from the city to suburbs, is noted by George E. Whitwell, vice president of Philadelphia Electric. He says, 24,000 new homes occupied by customers of company in 1952 was the greatest increase in residential customers in any year in the history of Philadelphia Electric.

More electric motors will be built and sold between now and 1963 than have been manufactured in the past 50 years, F. C. Ruling, manager of GE's Atlantic District, told some 150 members of General Electric Supply's sales organization recently in Hershey, Pa. As a result, he said, electrical manufacturing industry is expected to grow twice as fast as the rest of the economy.

Congratulations—Cooper Green will resign as mayor of Birmingham in April to become a vice president of Alabama Power . . . Fred R. Shedd, assistant division manager of South Bend division of Indiana & Michigan Electric, becomes vice president of Ohio Valley Electric Corp and Indiana-Kentucky Electric, an OVEC subsidiary.

Alton G. Marshall, East Schodack, is appointed secretary of New York PSC, succeeding Murray G. Tanner, deceased . . . Thomas Graham, Danville, Ill., is designated secretary of Illinois Commerce Commission.

New Proposal on an Old Problem

● Truman-appointed Missouri Basin Survey Commission reports its ideas for coordinating water resource development

● Report implies Corps of Engineers and Bureau of Reclamation have not done best of all possible jobs in the area

● Plan for a federal commission to direct the work flops on the Republican administration's lap

New plan for organizing and directing the little-coordinated water resource development program in the Missouri Basin was unveiled last week.

It came from the old Truman-appointed Missouri Basin Survey Commission. It landed squarely on the laps of the new Republican Administration and Congress.

Key recommendations will have tough going, but the 300-page report may serve as a starting point for the Republicans in evolving their own solutions to the thorny problem (EW, Jan. 5, p 15).

Conflicts and weaknesses of the present development program in the ten-state Missouri Basin are spotlighted, and many are traced back to Washington. Rivalry between the Army Corps of Engineers and Bureau of Reclamation, the report implies, has not always contributed to a sound plan for harnessing the Missouri and its tributaries.

To correct the complicated situation, the Truman-appointed group urged:

- Creation of a five-man federal commission to take over direction of planning, construction and operation of water resource development projects in the basin. This commission would depend on existing agencies, federal and state, to carry out much of the actual work.
- An annual resource budget prepared by the commission after consultation with other participating agencies.
- Provision for wider local participation in the direction and financing of resource development in the basin.
- The basin commission be given broad powers in managing electric power features of multi-purpose water projects from initial planning to final sale of energy generated.

Hint of problems still ahead came in the report itself. The eleven-man Truman group could not agree on the method of creating the agency which would direct development activities in the basin.

A nine-man majority held that the basin commission should be appointed by the President, confirmed by the Senate, and thus responsible almost entirely to the federal government. This majority did agree that members should be residents of basin states. Backing this viewpoint was Chairman James E. Lawrence, Lincoln, Neb., publisher, and Democratic Senators Thomas C. Hennings, Jr. of Missouri and James E. Murray of Montana.

But a three-man minority filed a sharp dissent to the federal commission idea. Instead, they argued that the commission should be created under a state-federal compact, which would give the affected states a strong voice in directing basin resource affairs.

Definition of the basin commission's duties and powers could best be worked out by common agreement between the state and federal governments in compact negotiations, said the minority. This group included Republican Senators Milton R. Young of North Dakota and Republican Rep Clifford R. Hope of Kansas.

Majority Viewpoint

Replying to this argument, the majority contended the compact approach between a group of states and the federal government "embarks on a field largely unexplored in the courts." Further, said the majority, most of the financing must come from the federal government and federal agencies will have to carry on most of the actual construction. It is only reasonable, therefore, that the federal government should retain much of the responsibility for directing these activities, they said.

It was agreed by all that an advisory committee representing the affected states should meet occasionally with the proposed basin commission to chart the course of waterway development. There was also wide agreement among the Truman group that provision should be made for larger financial participation by the state and local governments.

The Recommendations

The report carried these recommendations regarding electric power to be developed in connection with resource development:

- Hydroelectric power production should be undertaken only in conjunction with balanced planning of water use and control for many purposes. This makes it probable that most sites will have to be developed by the federal government, but it should not preclude the licensing of electric companies where possible.
- Thermal-generated power will be necessary to support the output of hydroelectric projects. Such energy should either be purchased by the federal system or generated at plants owned by or operated in conjunction with the system.
- Federal generating plants and transmission grid should be planned and operated as a unified, integrated system or a group of integrated systems. Normally, the transmission facilities should also be constructed and owned by the federal government. Agreements with other utilities for wheeling government-generated energy should be entered into only where they serve the public interest.
- Statutory preference clauses should be retained and rigidly applied.
- Rates should be as low as over-all cost recovery permits. As in the past, most of the construction of resource development projects would fall to the Corps of Engineers and Reclamation. The Corps has completed or has under construction projects costing an estimated $1.7 billion in the basin. The Bureau has completed or now has under construction projects costing $581 million. This represents roughly 45% of the work to be done in the basin by the Corps and only 13% of the work slated to be undertaken by the Bureau.

Conflict between these major federal construction agencies has been largely responsible for the haphazard planning and uncoordinated project schedules which has plagued the Missouri Basin. This conflict reached one climax in 1944 when the agencies submitted rival plans to Congress for harnessing the mighty Missouri.

The late President Roosevelt took advantage of this conflict to recommend creation of a Missouri Valley Authority, along the lines of TVA. To head off this possibility, which would have tossed them both out of the basin, the two agencies held a two-day reconciliation meeting in Omaha, Neb., and came up with a joint plan. This has come to be known as the Pick-Sloan plan—named for the Corps and Bureau officials who lead the reconciliation move. It is also referred to as a "marriage of necessity."

This plan was accepted by Congress, which refused to accede to the President's MVA proposal. But the Pick-Sloan plan has since been roundly criticized as hastily drawn and ill-considered. It made no pretense of coordinating the operation of projects once they were built. As a result, coordination of planning, construction and operation has fallen to a loosely-knit inter-agency committee. This committee, representing the six federal agencies most directly concerned with resource development in the basin has since provided what coordination there has been.

Work Speeded, Costs Cut at Chief Joseph Dam

Chief Joseph Dam on the upper Columbia River not only will be producing power earlier than had been anticipated but will cost less, the Corps of Engineers has revealed.

The first three 64,000-kw units now are scheduled to go into operation Sept. 1, 1955, three months earlier than the original schedule, according to Col N. A. Matthias, district engineer at Seattle. Sixteen generating units are to be installed by the end of 1958.

Ultimate installation of 27 units, with a total rating of 1,728,000 kw, would make the plant second in size to Grand Coulee among the world's power plants.

Estimated cost of the project has been reduced $12.5 million to $193,250,000, Colonel Matthias revealed.

MSA TEAM prepares to depart for Europe to investigate United States foreign aid establishments in Belgium and Holland. Leader of the mission is Paul B. McKee, (left) president of Pacific Power & Light Co. With him (l to r) are Hubert J. Soher, head of a San Francisco firm of economic consultants; Vice Admiral Monroe Kelly, U. S. Navy (retired); Russell L. Wardburgh, vice president of Guaranty Trust Co; and Edgar Smith, Oregon rancher. A sixth member of the group, William T. Hamilton, Ebasco Services, Inc, is already in Europe

McKee Serving on MSA Team

Pacific Power & Light Co's Pres Paul B. McKee has gone to Europe to join Mutual Security Administrator Harold Stassen's team evaluating U. S. aid programs for NATO allies. The Portland, Ore., private utility executive will be assigned to Belgium-Netherlands along with the Portland Chamber of Commerce's ex-president, Edgar W. Smith, and four other advisers. McKee has been named head of the mission to the Low countries.

McKee and Smith attended conferences in Washington, D. C., Feb. 9.

Other Foreign Assignments . . . This is not a new type of activity for McKee, head of PP&L since 1933. During World War II his knowledge of South America, the result of six years with Emprezas Electricas Brasileiras as president from 1927, was utilized by the government in development of Brazilian mica deposits. He was a special representative of the Metal Reserve Co in this project and also served as vice president of the Rubber Development Corp which was interested in production of natural rubber in the Amazon valley.

McKee joined California Oregon Power Co, Medford, Ore., as assistant to the president, when he finished at Stanford University in 1914 with a degree in electrical engineering. After 13 years with Copco and rising to the post of vice president and general manager, he left for the Brazilian assignment. He returned to the Pacific Northwest to become president and a director of PP&L.

McKee's wide knowledge of industrial development has been a contributing factor in PP&L's rapid growth and won national as well as regional recognition. He was a vice president of the National Association of Manufacturers in 1947; has been a member of the Business Advisory Council of the Department of Commerce since 1942, and was a vice president of the Portland Chamber of Commerce in 1940-41.

Assistants . . . Assisting McKee, besides Smith, will be Monroe Kelly, retired Navy vice admiral of Virginia Beach, Va.; Bert Soher, San Francisco economist; William Hamilton, an engineer now in Greece who will join the party in Europe, and Russell Wardburgh, vice president of the Guaranty Trust Co, New York, N. Y.

The Portland utility president said the report of the group will be filed with Stassen in March.

Big Decisions Face McKay

Interior head must rule shortly on consolidation of civil works construction, Hells Canyon, and Georgia Power offer

Proposed consolidation of federal civil works construction under the Interior Department is already getting attention from the new Eisenhower Administration.

This, along with two other high policy matters demanding quick action, puts Interior Secretary Douglas McKay under pressure before he can grab the reins of his new job. The two other matters:

- Shall Interior continue to press for federal construction of the $357-million Hells Canyon Dam on the Snake River in Idaho?
- Shall Interior enter a modified power "wheeling" contract with Georgia Power Co which would provide for transmission of power from Clark Hill Dam on the South Carolina-Georgia line?

Consolidation Plan . . . Along with its other government reorganization plans, the new Administration has dusted off the Hoover Commission proposal to transfer the civil works functions of the Army Corps of Engineers to the Bureau of Reclamation. Word in Washington is that the consolidation plan will be sent to Congress in the near future.

McKay, long an admirer and supporter of the Corps, is coming around to the belief that the bulk of the waterway projects can be better handled by a civilian agency. While reiterating his high regard for the Corps officers with whom he has worked in the Pacific Northwest, McKay is of the opinion that the military engineers appear to be "getting too big for their britches."

Opposition Seen . . . But no matter how the new Administration views the consolidation proposal, it still will have to run the Congressional gauntlet. It is doubtful that the lawmakers, even with the prodding of the Republican Administration, will forsake the Corps.

President Truman toyed with the same proposal last year, but dropped it like a hot potato after an air journey with Engineer Chief Lewis A. Pick to view flood conditions in the Missouri River Valley.

Hells Canyon . . . On the Hells Canyon project, McKay's decision is required by April 13. On that date hearings begin before Federal Power Commission on an alternate project which would be built by Idaho Power Co. Former Secretary Oscar L. Chapman vigorously opposed the Idaho Power alternative, and intended to carry this opposition to the FPC hearings.

McKay said recently he had not made up his mind on the Hells Canyon project, but indicated his views would depend on the engineering and economic facts in the case. He wants to get down to the bedrock facts—brushing away the public-private power controversy.

Accordingly he will have Reclamation Bureau specialists review the Hells Canyon plan during the next few weeks. Once his views are firm, he will decide whether to oppose the electric company proposal before FPC.

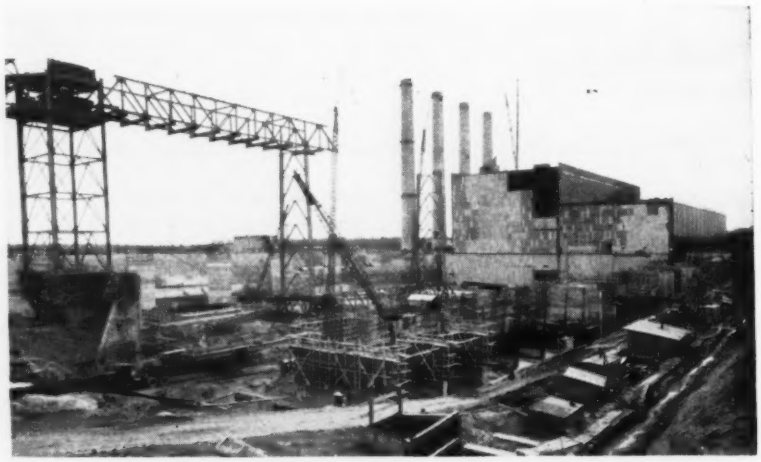
Georgia Power Offer . . . Transmission contract proposed by Georgia Power was turned down by ex-Secretary Chapman a few days before he left office. It is now before McKay.

Again because of the tedious and controversial public-private power issues involved, the contract is a political hot potato.

Under policies followed by the Democrats, electric energy generated at government projects was carried to designated customers either over government-built transmission lines, or over electric company lines for which the government paid wheeling charges. Priority customers such as public bodies and rural electric cooperatives became direct customers of the federal government, often at the expense of electric companies.

The proposed Georgia Power contract seeks a middle course. It would purchase power generated at Clark Hill Dam and transmit it over company lines to customers designated by the government. Thus the company would retain its customers, and the government's priority customers would also get a share of low-priced energy allotted them.

Attractive Rates . . . Service rates offered by the company are so attractive that at least one top Democratic Interior official thought Chapman should have signed the contract. But Chapman argued that the priority customers should be direct customers of the government, and the government had a further responsibility to provide supplemental energy if required.



Foundations for Power at Shawnee

Rapid progress is being made in construction of Tennessee Valley Authority's Shawnee plant near Paducah, Ky. In picture above foundation work can be seen for units five to ten. Building for the first four units is nearly completed. Boiler No. 1 is 80% complete and boilers for units 2, 3, and 4 are 54%, 24%, and 20% complete, respectively.

Depa Prepares . . .

. . . for end of material curbs, announces new developments affecting utilities

Preparing for shutdown or sharp curtailment of materials controls by June 30, Defense Electric Power Administration has announced these developments affecting utilities:

1. To prevent further slippage of power installations, Depa will undertake to extend directive aid to hard-hit electric utilities. Utilities are requested to report promptly to L. W. Clark, director of Depa's Materials and Equipment Division, any failure, after due diligence, to place orders for any materials, or to receive prompt delivery of orders which have been placed.

2. The agency is planning to halt the issuance of controlled material allotments for the third and fourth quarters of this year.

3. Allotments issued for the first two quarters will continue to be honored up until the June 30 deadline.

4. Office of Defense Mobilization is now considering means for maintaining construction schedules of vitally-needed generating plants after controls are dropped. These include plants scheduled to furnish interim, firm or backup power for Atomic Energy Commission installations.

E-5 Ratings . . . Depa recently extended E-5 ratings for some 50 power projects which will contribute to the AEC program. Projects with this rating have the same priority status as the direct AEC program. It is expected that ODM will recommend some control procedure for continuing this phase of the power expansion program.

Although plans are being made to drastically curtail Depa's operations by June 30, there is still no definite information as to what Depa functions may extend beyond that date. Whether a skeleton staff may remain to carry on the AEC power program still has not been determined, but ODM is expected to cover this in its present study.

Meanwhile Depa believes that attrition will continue to take care of the personnel problem. Number of employees now at Depa is lowest in its two and one-half year history, and the trend continues downward.

BPA Cable Laying—Dry Run

The bottom of Puget Sound has been reproduced at Ross substation of the Bonneville Power Administration at Vancouver, Wash., to conduct preliminary tests on a 230-kv submarine cable scheduled to cross Puget Sound north of Seattle, next year. Bonneville engineers are conducting design tests to determine the characteristics of a 10-in. steel pipe handled in the same manner as a flexible cable.

A site was selected with a slope approximately the same as the sides of the channel in Puget Sound. The pipe was rolled over the crest on a radius of 600 ft and suspended in the air for more than 250 ft, requiring a tension of 30 tons to support it in this catenary span. Strain gauge measurements were made as the pipe passed over the rollers. The Puget Sound installation will be the first attempted at water depths of 700 ft.

Yukon Power Surveys Authorized by Canada

The Canadian government has granted Frobisher, Ltd., Canadian exploration and development company, permission to conduct water power surveys in the Yukon with a view to establishing a large hydroelectric development on the Yukon-British Columbia border.

Because of the large power potential of Yukon lake and river basins it is conceivable that the hydro project under consideration would dwarf the $550-million project of Aluminum Co of Canada at Kitimat, B. C., which will have a capacity of 1.6 million hp. The Yukon area is believed to have a power potential of 5 million hp.

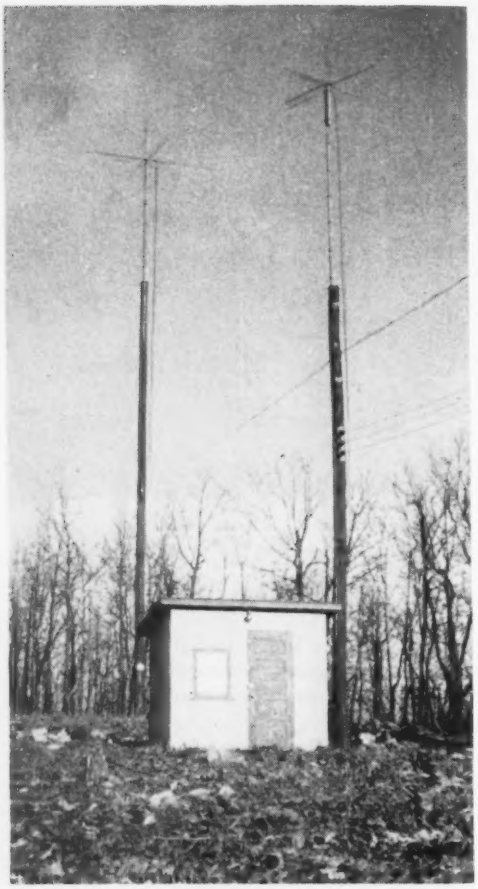
Resources Minister Robert Winters said the permit granted Frobisher will enable the company to make surveys in certain lake and river basins. The company is reportedly contemplating construction of two smelting plants in the area, should they prove feasible, for production of aluminum, magnesium, and a wide range of other metals.

Winters also confirmed that the Canadian government had rejected a bid by Aluminum Co of America to use Canadian waters to power a plant in Alaska. The company last August proposed to build a $400-million aluminum smelter near Skagway, Alaska.

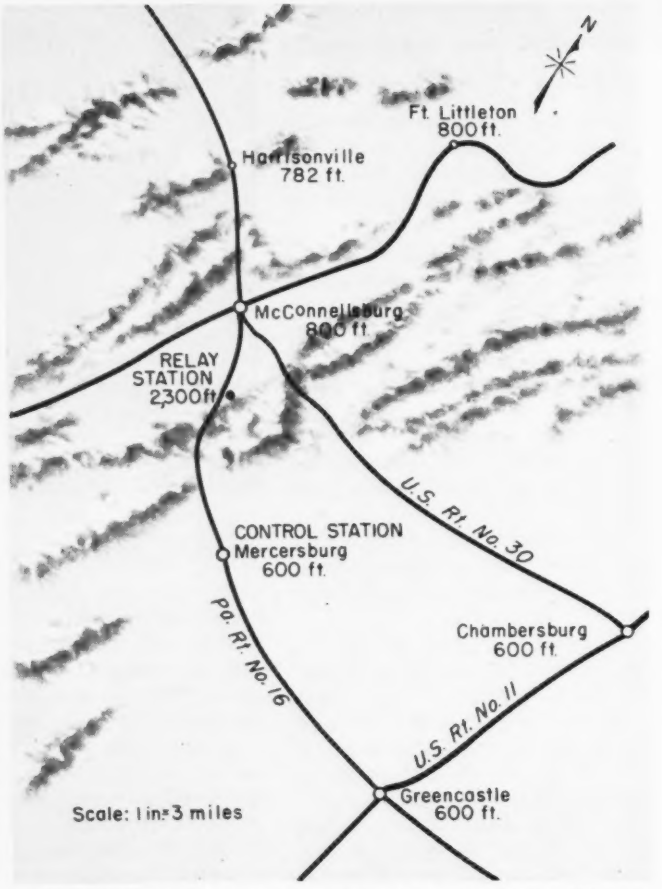
The Yukon River cuts through Alaska, but its headwaters are located in the Yukon Territory and northern British Columbia.

When asked if the Canadian government might approve the Alcoa proposal at a later date, a spokesman for the Resources Minister said, "I think it is very unlikely."

Alcoa officials, however, are hopeful of renewing negotiations with Canada and a spokesman for the company said the Yukon aluminum project "is still very much a live issue as far as we are concerned."



RELAY STATION automatically receives and transmits messages between cars and from cars to the control station. An engine driven generator supplies emergency power



SERVICE AREA of Cumberland Valley Electric Co is approximately 650 sq mi. This area is covered very effectively by the radio relay station located on top of Tuscarora Mountain, on elevation of 2300 ft (near center of map)

VHF Radio Relay Does the Job

$12,500 installation provides reliable communication for Cumberland Valley Electric Co. Customer service is improved by set-up which permits truck crews to talk to each other

A $12,500, VHF radio relay system is providing reliable communication throughout the service area of Cumberland Valley Electric Co. The three-frequency, two-way system was installed last year by the Mercersburg, Pa., utility.

Why Radio Relay? . . . For some time the company has needed a radio communication system to speed up customer services and the restoration of service after outages. But the conventional systems seemed inadequate.

Cumberland Valley felt the system should provide car-to-car communication 24 hours a day without the aid of night or weekend dispatchers. This was desirable for economic reasons and, also, because facilities weren't available for a 24-hour desk watch. In addition, it was felt that conventional systems were not completely effective over both the mountainous and flat terrain characteristic of the service area involved.

L. P. SCARBOROUGH, Electrical Engineer, Cumberland Valley Electric Co, Mercersburg, Pa.

These problems were overcome by locating a radio relay station at the summit of Tuscarora Mountain, elevation 2300 ft.

The radio relay system has an advantage over the conventional system. It is capable of car-to-car communication over a greater service area because of its advantageous position, higher sensitivity, and higher power output of the transmitter.

Fortunately, the Federal Communications Commission had just modified their regulations to permit radio relay operation in the industrial classifica-

tion. By making adequate showing to the FCC, the company secured permission to use the 37.58-Mc and 48.54-Mc bands for the relay and mobile transmitters, respectively.

Radio Relay Operation . . . The relay system receives a message on one frequency and automatically energizes and modulates a transmitter that repeats the intelligence on a different frequency. When used with numerous mobile units, the relay system receiver listens continuously at the frequency that mobile units transmit. Similarly, each mobile unit receiver listens continuously on the relay station transmitter frequency while the mobile unit is in use. If the relay station is located centrally and sufficiently high to be above obstructions, it can simultaneously receive a message from one car and retransmit it to other receivers in the system.

A decoding device in the relay receiver prevents operation of the station unless a code signal is present at the beginning of a transmission. A small coding device is attached to each mobile transmitter. This prevents transmitters of other companies from actuating the relay station.

Central Station Link . . . To tie the car-to-car communication system to the central control station at Mercersburg, the company first intended to use a wire link. The link would control the relay station by means of telephone lines or specially installed lines on the distribution poles. After consideration it was decided that a wire link was not sufficiently reliable because lines would be subjected to ice and sleet conditions. In addition, the poles, set along the mountain highway, would be continually exposed to the hazard of skidding automobiles.

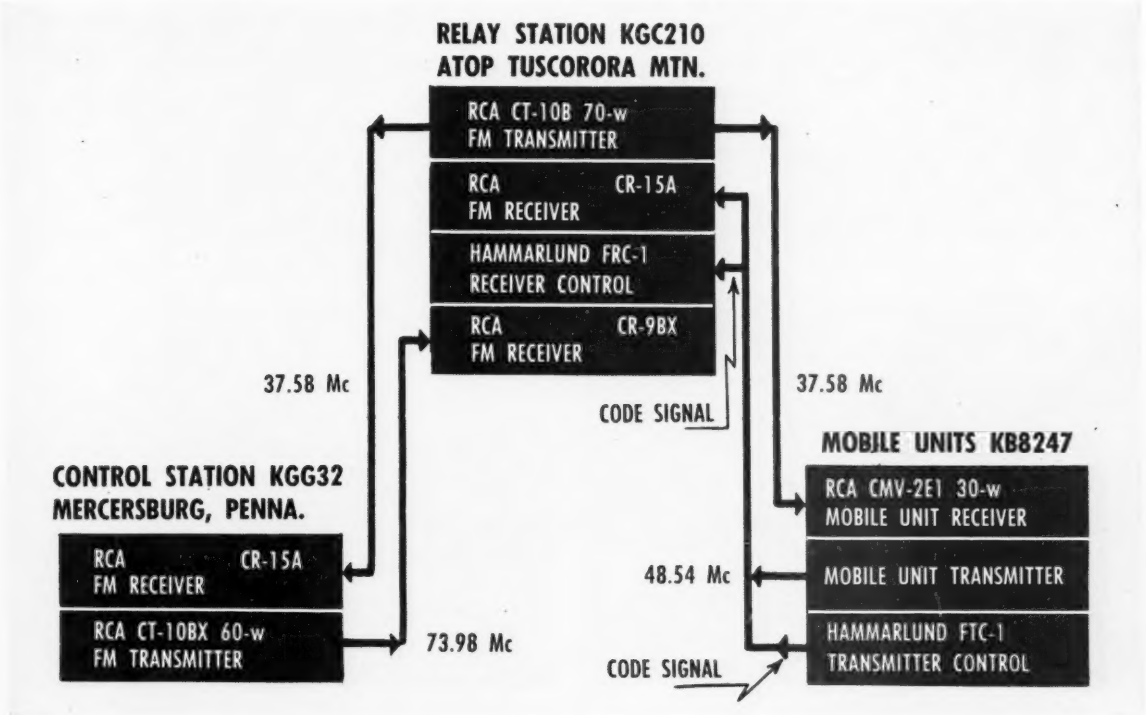
Therefore a radio link was installed between the central control station and the radio relay station. This radio link required still another frequency and another receiver at the relay station. No coding device was needed for this link because of the additional frequency.

The control station's receiver frequency is identical to that of the relay's transmitter. But the control station's transmitter is of a different frequency because the control station is catagorized as an operational fixed control station. The new frequency selected is in the VHF channel, 73.98 Mc band. It lies between TV channels 4 and 5. In some sections where these channels are received, serious interference could result. These TV channels are not received in the company's service area.

Accessory Equipment . . . To insure operation of the relay station during power outages, a gasoline engine driven generator was provided in the same building that houses the relay station. This emergency power supply automatically starts up and takes over in the event of a power failure.

Cars with mobile units are equipped with heavy duty generators to recharge the batteries after long periods of radio operation when the engine is shut off.

How Messages Travel Around the System



RADIO RELAY SYSTEM block diagram showing only one mobile unit. Ranges up to 50 and 75 miles are not uncommon. The link from Mercersburg control station to the relay station is 7 miles long and necessitates the installation of a third FM receiver at the relay station

Visioneering...

AO SIGHT-SCREENER RECORD

Name _____ Dept. _____ Clock No. _____ Date _____

Job Title _____ Eye Protection Used ☐ Male ☐ Female ☐ Age _____

Wears Glasses: Yes ☐ No ☐ At All Times ☐ Sometimes ☐ Work Only ☐ Reading Only ☐ Bifocals ☐

Date	RED SERIES — If the employee wears glasses at all times, he should be instructed to keep them on for this series.	Final Check Letters	Date	BLACK SERIES — If the employee wears glasses at any time, he should keep them on for this series.	Final Check Letters
1	Check letters reported: KR / KB / KR / KB — Alternation		1	Check letters reported: KR / KH / KR / KB — Alternation	
	FOR BOTH RED AND BLACK SERIES, IN 2, 5 AND 6 DRAW A LINE THROUGH EACH ERROR IN THE LAST GROUP READ				
2	E F TC DZEN BNEC EHZN FZEC TFEO ZNHT		2	E F TC DZEN BNEC EHZN FZEC TFEO ZNHT	
3	N F ET CDZE ZBNE NEHZ ECNF ETOF NTZH		3	N F ET CDZE ZBNE NEHZ ECNF ETOF NTZH	
4	Z E CE CNDZ EBNC ZHEC NEDF OEFT THNZ		4	Z E CE CNDZ EBNC ZHEC NEDF OEFT THNZ	
5	Draw line through letter under incorrect groups. 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 — A B C D E		5	Draw line through letter under incorrect groups. 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 — A B C D E	
6	Draw line through position reported for horizontal line. (Top of scale) . . . . . (Bottom of scale)		6	Draw line through position reported for horizontal line. (Top of scale) . . . . . (Bottom of scale)	
7	Draw line through position reported for vertical line. 2 4 6 8 10 12 14 16 18 20 22 24 26 28		7	Draw line through position reported for vertical line. 2 4 6 8 10 12 14 16 18 20 22 24 26 28	
	COLOR PLATES (DRAW LINE THROUGH ERRORS): 1 2 3 4 5 6 7 8 9 10				

NOTE: Interpretation is to be made by certificated ones.
Technicians are used to give any information about results. They are not to make comments or recommendations.

Referred for Eye Examination: Yes ☐ No ☐ Employee Notified _____ Examined _____ Fitted _____

570 Copyright, U.S.A., 1945, American Optical Company Chart No. 1235N

RECORD CARD sample for use with a visual screener

Report On Vision Check

To _____ Date _____

Dept. _____ Check No. _____

You will recall the recent VISION CHECK which you took as part of the company's plan for Visual Efficiency and Safety. Your VISION CHECK record has been studied by the practitioner who directs our vision program. His professional judgment indicates that:

☐ You passed the AO Sight-Screener vision check.

☐ You could benefit by an eye examination.

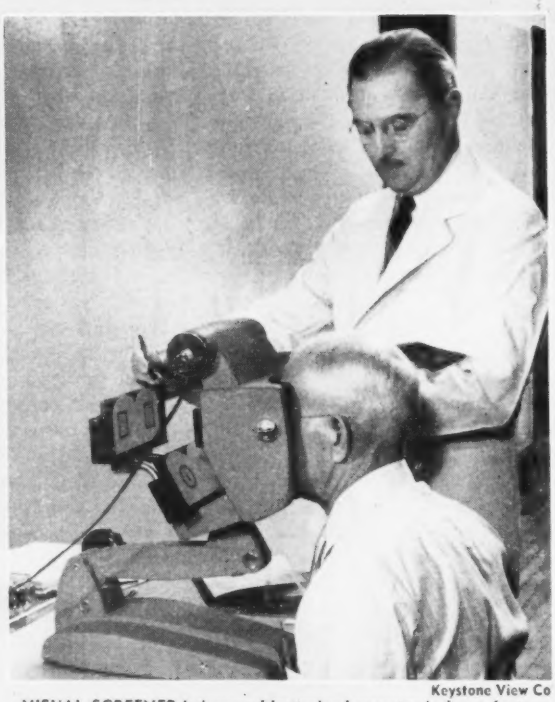
Your safety and performance on the job are influenced by your eyesight. If your results indicate need for a detailed eye examination, you may consult this department. We will be happy to assist you in securing professional care for your vision.

Signed _____

Dept. _____

320A Copyright 1945, American Optical Company Chart 1235-U

REPORT TO EMPLOYEE sample form by one optical company



Keystone View Co

VISUAL SCREENER being used by trained operator in large factory to make record of workers' eyesight to show ability to cope with possible visual defects and see if he is near-or far-sighted

VISUAL ENVIRONMENT

Illumination: Foot Candles on Task _____

Foot Candles on Surround _____

Are brightness ratios between task and surround

Good _____ Fair _____ Poor _____

Type of lighting units: Fluorescent _____ Incandescent _____ Mercury _____

Closed Top _____ Open Top _____

Louvered Top _____ Industrial Type _____

Commercial Type _____ High Bay _____

Localized _____

Comment: _____

Painting

Good _____ Fair _____ Poor _____

Color of Ceiling _____

Color of Walls _____

Location of natural light sources in relation to worker and visual task _____

Prepared by _____ On (Date) _____

ONE SIDE of suggested form for analyzing job visual requirements

JOB VISUAL DESCRIPTION

Company _____

Job Title _____ Dept. _____

Brief Description of Visual Tasks Performed _____

Principal Work Positions

Standing _____ Sitting _____ Working Aloft _____

Moving About _____ Other _____

Glare Condition

None _____ Direct _____ Reflected _____

WORK DISTANCES	POSITION OF WORK: Below Eye Level — Often	Below Eye Level — Seldom	Eye Level — Often	Eye Level — Seldom	Above Eye Level — Often	Above Eye Level — Seldom
Closer Than 14 Inches						
Reading Distance						
Arm's Length						
30 Inches to 7 feet						
7 Feet and Over						

LATERAL VISUAL SWEEP: NORMAL ( ) WIDE ( ) NARROW ( )

NATURE OF VISUAL HAZARDS: _____

EYE PROTECTION

Does This Job Require:

Welding Helmet _____ Face Shield _____ Goggles _____ None

REVERSED SIDE of suggested form for job visual requirements

A New Concept in Industrial Lighting

Increased production, more profits, and bigger payrolls can follow if utilities sparkplug visioneering programs that coordinate visual screening with good lighting and proper painting in local industries

PAUL HILDEBRAND, Lighting Director, Pennsylvania Power & Light Co, Allentown, Pa.

Visioneering is simply engineering for vision—the overall job of visual efficiency. It consists of three parts:

- A visual screening program.
- A good lighting installation.
- A good paint job, using proper colors.

And the entire program begins with the discovery of visual deficiencies by use of a visual screening program.

The importance of visual screening should not be underestimated. Consider, for example, the situation that prevailed not so long ago in Baltimore, Md. According to national estimates and local studies about four of every ten workers on the payrolls of Baltimore industrial plants and offices do not have the eyesight required for their jobs. They are not blind, but their eyesight is deficient. They can do their work, but they miss small details. Most important of all, they frequently do not realize their vision is poor.

Baltimore has done something about it. As a part of the vision testing service now available to plants on a yearly basis, the Maryland Society for the Prevention of Blindness provides a lighting and eye-safety survey by engineers from cooperating organizations. The Consolidated Gas, Electric Light and Power Co of Baltimore, Safety Engineering Club, and Safety Council have actively assisted by contributing the services of their technicians and members. Reports from these surveys are also tailored for the smaller plants. They emphasize basic improvements in seeing conditions and eye protection. Recommendations are made to achieve maximum results with minimum expense. These reports, and the analysis of the visual survey results, are furnished confidentially to the management.

This is visioneering at work.

Check Eyesight . . . No matter how good the surroundings are so far as brightness ratios are concerned, if the eyes of the worker are not up to maximum efficiency these other benefits will not fully apply to him. Therefore, the first thing to do is check the eyesight of all workers. That sounds as though it might be expensive and complicated, but it really isn't.

Three optical companies manufacture reliable instruments with which a trained operator can easily determine whether or not an employee has any visual defects. The instruments, which can be bought or rented, make a record of each individual's eyesight. The record shows an individual's ability or inability to cope with several different possible visual defects and determines whether he is near- or farsighted. The employer is advised of the findings and the employee can get glasses, if he needs them, from any specialist of his own choosing and at his own expense.

Results Worthwhile . . . The system entails some expense to plant management. Management must pay the vision specialist for his service in evaluating the record obtained through use of the testing instrument. But results are well worth the expense and effort because employees are enabled to see better and work better, with less spoilage and fewer accidents. That has been proved time and again in many of the largest industrial plants in the country.

Here are a few examples of the advantages some industries have found in using the visual screening process for its employees. In one hosiery mill it was discovered that operators who rated low on the Snellen letter chart test—a test for distant vision only—were the best producers on the looping operation (a near point visual task). If the company had used the Snellen test alone as the basis for

BEFORE RELIGHTING meter repair shop, 750-w totally indirect incandescent units provided illumination considered good 20 years ago. Visual task in shop is repairing and cleaning meters—fine work

AFTER RELIGHTING and repainting same shop, average intensity is 75 ft-c. All-metal commercial type fluorescent units are installed. Note that some light is directed to ceiling. No local lighting is required

selection or promotion procedure, it might have eliminated many of its best employees.

Case Histories . . . Motorola, Inc, Chicago, had an interesting experience with its visual screening program. One hundred employees in the out-going inspection department were visually tested. Results disclosed that 30% of the employees failed to meet the standard of visual skill required for their respective jobs, and of these 63% had been termed below-average workers by their supervisors. Within two months after the visual program was started, rejects had been reduced by 75%.

R. H. Donnelley & Sons, also of Chicago and one of the country's leading printers, has seen compelling proof of the importance vision has to job performance. Proofreaders who meet the minimum visual requirements are 37% more accurate than those who fail to meet those standards. Higher efficiency and a net productive value increase of 12¢ per manhour result.

Results like these and many others are money in the bank for industrialists. Those results are the bluntest and best kind of answer to the question of why bother with visual screening? In this case it pays to bother. There is no question but that correction of visual defects of employees will go a long way in preventing accidents, reducing waste, and speeding up production.

Good Illumination . . . But visual correction is not enough. The factory manager must have good illumination if he is to insure all the benefits from a visual correction program.

Today in industrial lighting we don't consider alone the matter of intensity or footcandles. An adequate quantity of light to fit the visual task, of course, is necessary. But we are aiming more and more at better quality in lighting. All too often we see industrial plants in which the ceiling is in absolute darkness. A small amount of light should be thrown up to the ceiling to reduce this cavern-like effect! With the equipment available today, this is easily done. Instead of conventional industrial reflectors which consist of a piece of white enameled metal, use of the newer type unit with slots in the top will permit the escape of some illumination upward.

Or better yet, why not use some equipment classified as commercial? These are of all-metal construction with wide louvers which give good shielding from the glare and brightness of the lamp and permit even more light to escape to the ceiling. As an example of this, consider the relighting of my own company's meter repair shop at Hazelton, Pa.

A Shop Relighted . . . Before the shop was relighted, it was equipped with 750-w incandescent lamps. For want of a better name, the fixtures were called "cuspidors." The visual task in the area is repairing and cleaning meters—fine work. Lighting was poor, yet considered good according to the standards of 15 or 20 years ago.

An all-metal commercial luminaire which had been originally designed as a schoolroom lighting fixture was used in relighting. Now, seeing is easy in every part of the shop. The average intensity is in the neighborhood of 75 ft-c and, although meter repairing has a visual task comparable to watch repairing or clock repairing, no local lighting is required. Our records indicate an increase of 48% in production since the new lighting was installed. Ceiling, walls, and columns are all painted in light colors. Tabletops, too, are of a light color.

Color Is Important . . . Because a building is used as a factory is no reason it should look like a cave. The ceiling doesn't have to be black because no light strikes it. The walls do not have to be gray. We don't use gray paint on the walls of our schoolrooms nor in our offices. Why do we use them in factories?

Color is being widely used in industrial plants in many ways. For instance, yellow is used to indicate "watch out." Red is being used to indicate "fire protection." Green is used to indicate "safety or first aid." Purple is often used to indicate "extra valuable materials."

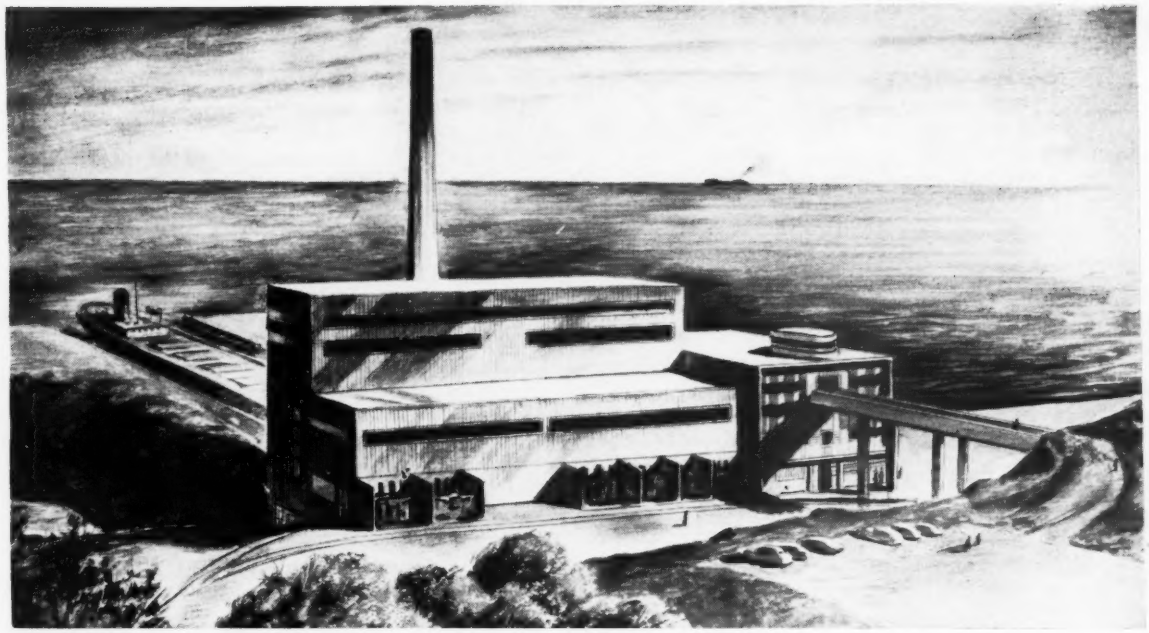
Everyone seems to agree that ceilings, if they are not painted white, should be of a very light color with high reflective values. In the case of high ceilings, the upper part of the walls should also be painted white or a light color to match the ceiling. Walls may be painted in a light pastel shade such as green, buff, or light blue. Final choice of wall color is determined by many factors but its main purpose is to focus attention on the actual work areas by making surrounding areas less bright. Wall and dado colors should be harmonious and, for the sake of variety, should be different from the color of the materials fabricated. Soft, light tones of good light reflective value are best.

Many people recommend painting the floors a light gray. This cannot always be done, because in some factories the floor is oil soaked and paint will not stick. But when conditions permit, a freshly painted floor of proper color simplifies maintenance. Everyone prefers color to the ordinary black and white and gray. And in the factory it not only aids good seeing conditions but also tends to improve the morale of the factory worker.

Visual Screening . . . The paint salesman, the lighting industry, and the representatives of the optical companies are all trying to sell visual efficiency to the industrial plant manager. But representatives of the optical companies do not bother to any great extent to sell their products to the small manufacturer. In Pennsylvania, 90% of our industries employ 50 or fewer workers. In those cases the purchase or rental of a visual screener is almost prohibitive, since only a small number of employees is involved. If we can solve this problem of the small manufacturer securing the services of visual screening, and if we can get the full cooperation of the paint people and the lighting industry together with the representatives of the optical industry, we can go a long way to increase "Production for Freedom" in the small plant.

Utilities Should Sparkplug . . . To accomplish this, I propose the following plan: The electric utility company because of its interest in the prosperity of the communities which it serves should be the sparkplug and originator of this program. Representatives should first contact any of the optical companies that manufacture the visual screener and rent or purchase one. Having done this, a local group of vision experts should be thoroughly trained and acquainted with the operation of the screener. The next step would be to sponsor a meeting of local vision specialists, paint company representatives, fixture manufacturers' representatives, electrical distributors, contractors, and interested utility personnel. At this meeting the complete local program for putting

(*Continued on page* 212)



OAK CREEK STATION has no structural frills, since its inconspicous location allows a purely functional design. Walls for the turbine and boiler rooms are corrugated asbestos concrete. Personnel enter via bridge to sixth floor of adjoining service and control building

Milwaukee Gains Efficiency Through Low Back Pressure Design

Nearly ideal cooling water supply allows 0.5-in. back pressure at Oak Creek station. Steam will be 1,575 psi, 1,000 F, reheat 1,000 F. Four 120,000-kw units are planned

O. J. STALLKAMP, Assistant Chief Designer, Wisconsin Electric Power Co, Milwaukee

Oak Creek Station of Wisconsin Electric Power Co on Lake Michigan, ten miles south of Milwaukee, has been designed for high efficiency. Its 1,575 psi, 1,000 F and 1,000 F reheat steam generation is expected to give an exceptional Btu rate. The first of the four 120,000-kw units will go into operation in May.

Such features as radiant superheaters, radiant reheaters, bin and feeder firing of coal, single boiler and turbine are also found in the company's Port Washington and Lakeside Stations. But cross-compound turbines, controlled circulation boilers, vertical pumps, pressurized circulating water tunnel, and centralized control make their first appearance on this system at Oak Creek.

Turbo-Generator . . . The cross-compound turbo-generator consists of a 3,600-rpm, 80,000-kw, high-pressure machine and an 1,800-rpm, 40,000-kw, double-flow, low-pressure machine. Tied together electrically, they will operate as a single unit. Final design followed study of ten arrangements involving 3,600- and 1,800-rpm, tandem-compounding and cross-compounding using two to seven exhaust flows.

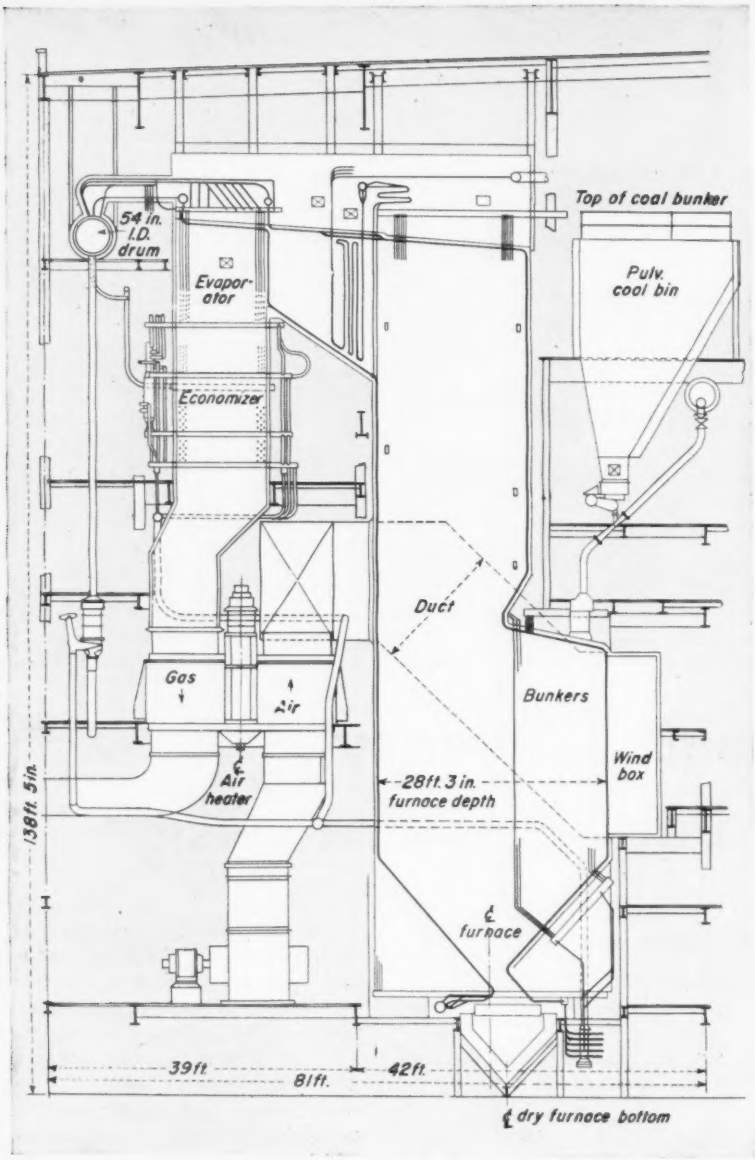
Cross-compounding the 3,600-rpm high-pressure and 1,800-rpm low-pressure turbine secures the advantages of each. It also obtains the most economical balance of investment and operating costs for expected load conditions.

Smaller wheels and shafts on the 3,600-rpm section permit minimum peripheral clearance for blades and allow seals which reduce interstage leakage about 3%. Also, there is less disc friction. However, exhaust blading for a 3,600-rpm turbine cannot be made long enough to pass efficiently the tremendous volume of steam expanded to 0.5 in. back pressure. The 1,800-rpm turbine with one condenser replaces a 3,600-rpm turbine with six exhaust wheels and multiple condensers. The unit is impulse-reaction type with reheat and six extraction points for feedwater heating.

Electrical Features . . . The 13.8-kv generator is connected by bus duct directly to a 145,000-kva transformer to step up to 132-kv. This transformer is outside the turbine wall and has barriers on both sides.

One 10,000-kva auxiliary transformer is tapped off the generator leads without switches to supply 4,160-v service to plant auxiliaries. A second transformer steps down to 4,160 v from the 132-kv bus. Manual transfer switches are provided. Load center substations with duplicate transformers step down to 480 v.

Motors 150 hp and larger are 4,160 v and smaller motors are 480 v. A



PULVERIZED COAL FIRING has superheat and reheat temperatures controlled by differential firing. Induced draft fans are outdoors on the discharge side of the dust collector

small number of 250-v dc motors for coal feeders and magnetic separators are supplied by a motor-generator set and storage battery.

Two exciters driven by the low-pressure turbine and a motor-driven starting exciter provide excitation for the generators.

Centralized Control . . . Centralized control panels for the two boilers are located on El. 72 ft. Panels for the turbines are located on El. 33 ft, because it was not possible to place boiler and turbine panel boards together.

Operating personnel for four units will be about 97 men on a three-shift basis, including relief for vacations, sickness, and training. This equals 0.2 man per rated mw. Total plant personnel including supervisors, technicians, office, janitors, maintenance and yard crews will be about 163 men or 0.34 man per rated mw.

Condenser . . . Lake Michigan's abundant water permits the 0.5 in. back-pressure condenser design. The average temperature is 46 F, varying from 32 to 75 F. Supply is constant, and lake level has not varied more than seven feet. The water is non-corrosive, clean, requires little chlorination, and debris is negligible except for winter ice and occasional fish and weeds. These advantages are being exploited to obtain the lowest economical back pressure by use of large exhaust blading, large flow area, large condenser, and efficient pumping of water.

A study of 161 combinations of surface, pumpage, size, gauge, and length of tubes determined the selection of condenser characteristics. They specify 85,000 sq ft, ¾ in. by No. 19 ga 30-ft inhibited Admiralty tubes, single pass and 110,000-gpm water. Shell, water boxes, and tube sheets are steel. Two vertical condensate pumps are set in the floor alongside the condenser, and two steam-jet pumps for air removal are arranged for remote operation. Rupture discs are provided instead of atmospheric relief valves.

Tunnels and Pumps . . . The separate pump house has a trash bar screen and three 10-ft-wide travelling screens. Four 96 by 72-in. axial flow vertical pumps, each driven by a 700-hp, 345-rpm motor, discharge into a common tunnel to supply four condensers. Tunnel velocity of 7 fps and streamlining minimize flow resistance and reduce pumping head to 17 ft. The discharge tunnel is gravity, arranged for recirculation to combat ice formation at the intake. Three pumps can serve with somewhat reduced flow. Should ice jam the intake, flow can be reduced to one-fourth with some sacrifice in vacuum.

The pump house also contains four 2,000-gpm, 70-psi vertical service pumps and two 1,000-gpm, 145-psi booster pumps for special uses. Strainers on the discharge side of low-pressure pumps are designed for quick-purge back washing with an air accumulator pressure tank.

Half the service water capacity is provided for cooling turbine and transformer oil, but condensate can be used with a small gain in cycle economy most of the year. Oil coolers are in pairs, one cooled by service water and the other by condensate. Oil is valved to either cooler depending on conditions.

Controlled Circulation Boiler . . . A single boiler supplies a single unit with no piping interconnections for main steam, reheat steam, or feedwater. The boiler is designed for 1,750

psi and is controlled circulation type.

It has three 3,500-gpm, single-suction, constant-speed pumps driven by 200-hp motors to circulate water to various heating surfaces. Two are sufficient for full load, and the third is spare. The circulation rate will be four times steam generation rate. At the entrance to the water-wall tubes and other heating tubes, orifices of predetermined size control the amount of water in proportion to heat transfer. Smaller and safer tubes are possible in this design of boiler and less steel and less water are required.

Superheaters . . . The primary radiant superheater on the furnace back wall is connected in series with a primary convection superheater. They have counteracting characteristics which will produce practically constant outlet temperature throughout the load range. Radiant reheaters form the side walls of the furnace. Furnace volume of about 107,000 cu ft and a heat release of about 10,000 Btu per cu ft per hr at maximum load will limit furnace temperatures so that no slagging is anticipated.

Feed Water . . . The turbine has six stages of feed-water heating. Three low-pressure, single, full-size horizontal heaters are in the turbine room, and three high-pressure, dual, half-size vertical heaters, in the boiler room. For high-pressure service, investment cost for dual half-size heaters without bypass valves is less than for single full-size heaters with bypasses. Drains from No. 6-5-4-3 heaters will be subcooled in integral coolers and cascaded, and the drains from heater No. 2 and 1 will be pumped into the stream.

Two 10-stage, half-capacity feed pumps are driven by 1,500-hp, 3,600-rpm constant-speed motors. Feedwater flow is regulated by three-element controllers. A demineralizer softener with 64-gpm sets has been installed with Unit 1. It will provide about 2% makeup for the ultimate four units.

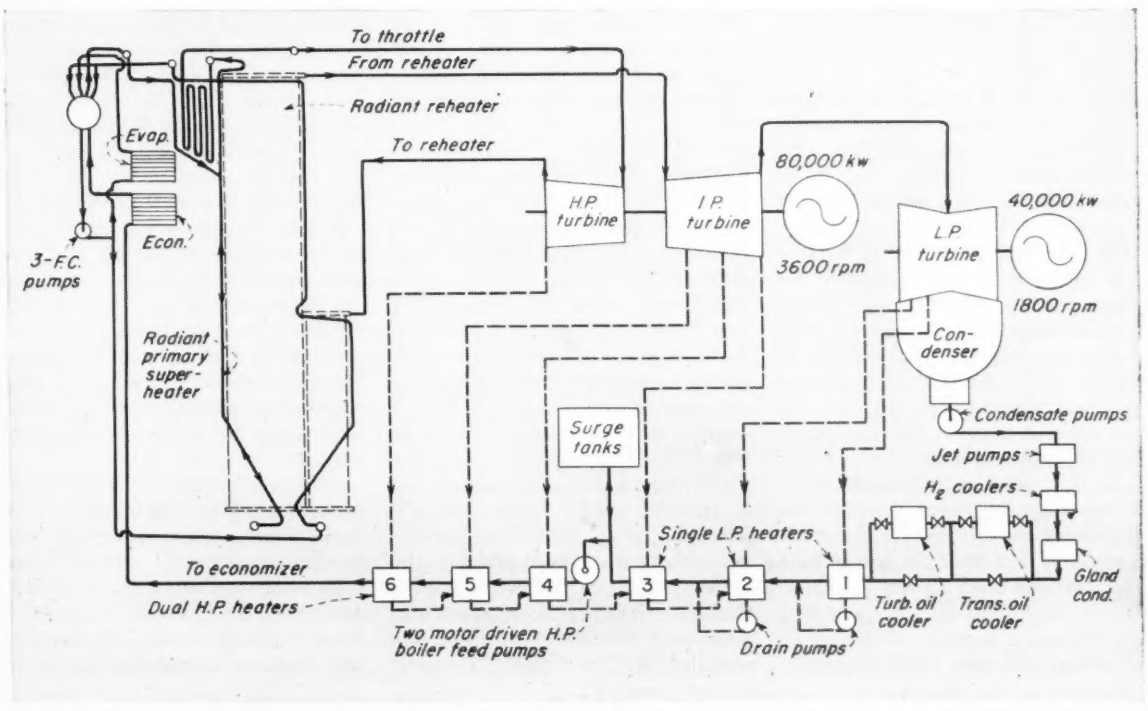
Piping . . . Main steam piping from the primary superheater to the turbine throttle will be 15½ in. OD, 11⅛ in. ID, forged and bored piping. No stop valve is planned ahead of the throttle, but there will be two intercepting valves and two dump valves in the reheater outlet piping. There will be no bypasses for warming up.

Fuel Preparation and Firing . . . Two 25-ton-per-hr roller mills will pulverize coal which will be separated by cyclone collectors and blown to a 500-ton bin. In the milling process, coal is dried by flue gas.

Outdoor induced draft fans are driven by 600-hp, 514-rpm, slip-ring motors with drip-proof housings and dust filters. Liquid rheostats in the boiler room are positioned by automatic combustion control to regulate fan speed. Two forced-draft fans in the boiler room have 500-hp, 1,200-rpm, slip-ring motors. Their liquid rheostats are served by a common electrolyte cooling and tank system. Forced-draft fans have extra capacity to provide recirculation of heated air to two air heaters to control corrosion and clogging at the gas outlet.

A dry furnace and absence of slag permit handling ash dust from the furnace bottom by a vacuum conveyor using water operating ejector nozzles.

Building Construction . . . Wisconsin winters demand complete housing of turbine and boiler equipment, excepting induced-draft fans, dust collectors, and breechings. Building design is functional and without architectural fantasy. Walls for the turbine and boiler rooms are corrugated asbestos concrete with insulation only in turbine room.



HEAT FLOW DIAGRAM shows controlled-circulation boiler and cross-compound turbine with six-point extraction which contribute to high efficiency. Cold condensing water is a big factor. The 1,800-rpm and 3,600-rpm generators are tied together electrically

MEETING REPORT

Aluminum Connections . . .

. . . are discussed at EEI Transmission and Distribution Committee meeting. Solution of difficulties viewed as slow

Progress in solving the connection problem precipitated by resort to aluminum conductors is proving to be slow. Only this conclusion could be derived from a discussion at the meeting of Edison Electric Institute's Transmission and Distribution Committee in Washington, Feb. 12-13.

F. W. Myers, Philadelphia Electric Co, who opened the session, said the purpose was to determine how many of the original problems remained unsolved. C. E. Baugh, Pacific Gas & Electric Co, said his company was continuing its test rack study but with new setups. Many of the original ones, he said, failed in a few months except where the conductors were thoroughly covered. Investigation showed some "better" methods in Britain did not live up to claims, he added.

Inhibiting Grease . . . Differential expansion with steel bolt connectors leads to cold flow and later poor contacts unless some compensation is provided. W. L. Rush, Louisiana Power & Light Co, mentioned difficulty in getting linemen to apply inhibiting grease before a new grease pot was obtainable. Richard Harap, Burndy Engineering Co, suggested two compounds might be needed, one to inhibit oxidation and the other to serve as a seal.

M. D. Holcomb, Reliable Electric Co, declared it was imperative for users to agree upon tests and specifications before the manufacturers could know the performance to aim for in design. R. W. Kunkel, A. B. Chance Co, said manufacturers' test data do not differ as much as the conclusions and objectives of users.

E. J. Coupal of Niagara-Mohawk Power Corp, expressed the hope for interchangeability between makes of connectors and the tools (or at least the dies) and Rush agreed with him. Harap decried the tendency to adopt an increasing number of conductor strandings and sizes. Joel Tompkins, Aluminum Co of America, said cold-welding of aluminum joints and splices was under study.

Standard Sizes . . . Adverse comment on the lack of standard sizes was met by the report of a subcommittee presented by M. H. Pratt, Niagara-Mohawk. The majority of the ballots favored their recommendation for sizes. Even stronger support was given at the meeting for designating the sizes as 5/0, 6/0, etc, and for passing the proposals along for recognition by appropriate standardizing bodies.

Radial systems are not likely to yield rapidly to networks for underground said W. J. Witte, Consolidated Gas Electric Light & Power Co of Baltimore, in justification of a panel discussion of sectionalizing and protective devices for underground. Several large-city systems reported comparatively little necessity for frequent inspection and test, indicating that the devices generally are more dependable than the cables they protect. Chairman J. A. Pulsford held out for networks, doubting that adequate service can be rendered by an underground radial system without excessive resort to the sectionalizing and protective devices under discusssion. It is just as inexpensive to convert to networks, he felt.

Exhibits . . . Several companies brought in exhibits for the underground "gadget" show: Kansas City Power & Light Co, a weather-tight cable splicer's truck; Wisconsin Electric Power Co, a new cable-pulling eye; Consolidated Gas Electric Light & Power Co, a heater for splice and pothead compounds, tools for applying and removing armor-rod clips, voltage detector for 13-kv feeders; Cincinnati Gas & Electric Co, a leak detector for gas-filled cable; Public Service Electric & Gas Co, carrier control multiple street-light relay, new 15-kv impulse fault locator by J. G. Biddle Co, and a gaff gauge for lineman's climbers; Consolidated Edison Co of New York, water and vaporproof envelope for pre-dried oil filter paper; Potomac Electric Power Co, globar resistor to save lamps by attenuating surges from oil burner ignition transformer.

Some 500 homes in Virginia Electric & Power Co territory have been built with glass panel heating and another 450 with ceiling "sandwich" panels, W. J. Blake reported. These were mostly in fringe areas and, he said, 25 kva transformers had to be installed to serve each four homes. Rooms ranged from 5 to 9 and demands from 7 to 12.6 kw; kwhr per kw per degree day ranged from 0.22 to 0.614. Demands dropped off from 25% to 44% after the first winter, presumably due to supplemental heating, White declared.

Voltage Unbalance . . . Unbalance in 3 voltage awaits a standardized definition said A. S. Anderson, Ebasco Services, Inc, and he proposed using the ratio of negative to positive sequence voltages as an index. In reporting an analysis of some 1,209 polyphase system samples of voltage unbalance, J. W. Anderson, Philadelphia Electric Co, said the maximum found was 10% (for open delta) and 5.94% (closed delta) but the great majority showed 1.5% or less. The report on motor starting currents for air-conditioning will be ready soon, he said.

Inhibitor . . . Inhibitor is again generally available and transformer manufacturers have resumed using the additive for oxidization and sludge prevention. Frank C. Doble, Doble Engineering Co, reviewed the events since the 1950 adoption was reversed, adding that every gallon of new oil is worth inhibiting with DBPC. Allis-Chalmers Manufacturing Co put it into transformers up to 167 kva and, according to R. W. Beard, sees no apparent justification for use in circuit breakers. H. M. Jalonack concurred as to circuit breakers but said General Electric is opposed to use in oil fuse cutouts because there is a reduction in interrupting ability after repetitive operation.

G E puts inhibitor in transformers up to 500 kva and all secondary network transformers. Additional cost is only about ½%. Westinghouse stops at 167 kva and F. G. Ford feels oil life will be tripled by the DBPC. M. I. Zwelling of Line Material Co said inhibitor should not be added without continued development of materials and interior designs and also of the accelerated life tests of oil.

Contract Clause Closes Delaware Municipal Plant

Dover, capital city of Delaware, has closed its municipal generating plant for the rest of the month to take power exclusively from Delaware Power & Light Co, with which it has a minimum-use contract.

A clause in the contract requires that the city pay for a minimum of 1,080,000 kwhr for the month of February, whether it uses that much power or not.

City Manager G. Preston Ward said that since Dover must foot this bill, it might as well draw all its current from the power company. Demand is not expected to exceed the contract amount this month. Ward added the municipal plant would be closed whenever a similar situation arose until the DP&L contract expires in October.

"And when it expires," he said, "we have no intention of renewing it."

A spokesman for DP&L said the utility's contract called for 400 hours use when any new demand was set. Dover's demand, he said, recently went up to the 1,080,000 kwhr figure. He added that he doubted the contract would be cancelled by the city in October, but that the city at that time might ask for changes. He pointed out that the Dover municipal plant is inadequate to supply the city's entire need.

POWER BRIEFS

● Two Italian specialists hired by El Salvador have reported favorably on the possible commercial use of local volcanoes as a source of power. The Italians reported "the several fumeroles investigated demonstrate excellent possibilities for development" and recommend trial perforations to determine the best utilization. The plan, it is hoped, may be a solution to El Salvador's power shortage.

● Colorado River runoff this spring might fall 60% under last year's record, but there is enough hold-over storage in Lake Mead to assure adequate water for power obligations and irrigation and domestic uses, according to E. G. Nielsen, director of Bureau of Reclamation Region III. Runoff is expected to be only 5.6 million acre ft compared with more than 14 million last year. The 30-year average runoff is 8.9 million acre ft.

● Societe de Bank Swiss expressed an interest through a Japanese overseas office in granting a loan to Japan's five-year hydroelectric power development program, a source close to the Ministry of International Trade and Industry has reported. The expected Swiss bank loan is reported to be conditional to a certain amount of imports of Swiss electric machinery for the development project.

● Extended drought in northern Norway threatens complete shut-down of power plants in many parts of the area. Strict rationing of electricity has been put into effect in Narvik, Bodö, Harstad, Troms, Hammerfest, and at the Glomfjord ammonia plant.

Changes in Capacity Reported to FPC

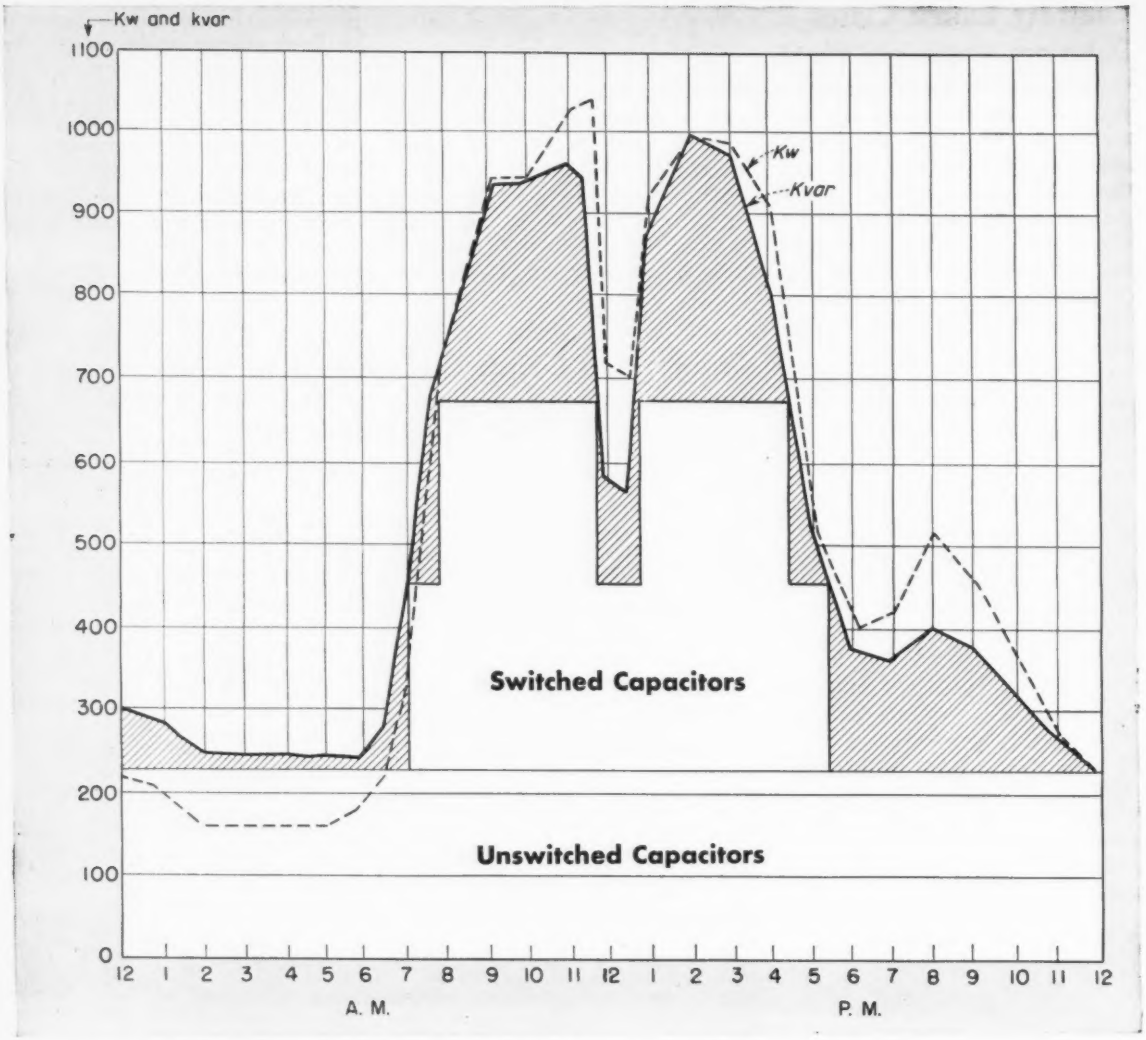
PLANT ADDITIONS DURING DECEMBER

State	Utility	Plant	Fuel	Capacity (kw)
N. Y.	Niagara Mohawk Power Corp	Albany	S	80,000
Mich.	Consumers Power Co	Whiting	S	85,000
Minn.	Le Sueur Electric Light & Water Department	Le Sueur	IC	1,300
Minn.	Two Harbors Municipal Water & Light Plant	Two Harbors	S	1,000
Minn.	Dairyland Power Cooperative	Twin Lakes	IC	2,500
Minn.	Federated Rural Electric Association	Jackson	IC	1,230
Iowa	Greenfield Municipal Utilities	Greenfield	IC	1,240
Mo.	Northeast Missouri Electric Power Cooperative	South River	S	15,000
N. D.	Northern States Power Co	Mobile Diesel	IC	760
Kan.	Kansas Power & Light Co	Lawrence	S	30,000
Md.	Consolidated Gas, Electric Light & Power Co of Baltimore	Gould Street	S	100,000
Va.	Virginia Electric & Power Co	Chesterfield 1	S	90,000
N. C.	Duke Power Co	Riverbend	S	100,000
Ky.	Louisville Gas & Electric Co	Paddy's Run	S	65,000
Tenn.	Tennessee Valley Authority	Hales Bar	H	24,300
Tenn.	Tennessee Valley Authority	Pickwick Land	H	36,000
Ark.	Corps of Engineers	Bull Shoals	H	40,000
Tex.	West Texas Utilities Co	Ft. Stockton	IC	5,000
Tex.	Central Power & Light Co	Victoria	S	30,000
Mont.	Bureau of Reclamation	Hungry Horse	H	71,250
N. M.	Southwestern Public Service Co	Carlsbad	S	15,000
Utah	Utah Power & Light Co	Gadsby #2	S	75,000
Nev.	Carlin Municipal Electric Light Plant	Carlin	IC	455
Wash.	Seattle Department of Lighting	Ross	H	90,000
Wash.	Public Utility District No. 1 of Chelan County	Rock Island	H	22,500
Wash.	Public Utility District No. 1 of Chelan County	Rock Island	H	22,500
Wash.	Public Utility District No. 1 of Chelan County	Rock Island	H	22,500
Calif.	Pacific Gas & Electric Co	Bear River	H	29,700
Calif.	Pacific Gas & Electric Co	Moss Landing	S	112,500

PLANT RETIREMENTS DURING DECEMBER

N. Y.	Niagara Mohawk Power Corp	Minetto	H	1,600
Mich.	Consumers Power Co	Hesperia	H	200
Mich.	Consumers Power Co	Stover	H	120
Mich.	Consumers Power Co	Blissfield	S	1,250
Minn.	Otter Tail Power Co	Frazee	H	75
Minn.	Otter Tail Power Co	Twin Valley	H	176
Iowa	Iowa Southern Utilities Co	Creston	S	1,000
Iowa	Greenfield Municipal Utilities	Greenfield	IC	200
Iowa	Interstate Power Co	Waucoma	H	30
S. D.	Northern States Power Co	Mobile Unit	IC	760
Kan.	Stafford Municipal Power Plant	Stafford	IC	136
W. Va.	Monongahela Power Co	Elkins	S	225
S. C.	South Carolina Electric & Gas Co	Columbia	H	750
S. C.	South Carolina Electric & Gas Co	Columbia	H	1,000
Fla.	Florida Power & Light Co	Live Oak	S	408
Fla.	Florida Power & Light Co	Lake Butler	IC	60
Fla.	Florida Power & Light Co	Waldo	IC	56
Fla.	Florida Power & Light Co	Sebastian	IC	130
Ala.	Birmingham Electric Co	Birmingham	S	8,000
Ark.	Southwestern Gas & Electric Co	Mena	IC	640
La.	Louisiana Power & Light Co	Donaldsonville	IC	376
La.	Louisiana Power & Light Co	Jena	IC	120
Okla.	Oklahoma Gas & Electric Co	Alva	IC	570
Tex.	Dallas Power & Light Co	Dallas	S	1,250

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of Jan. 1—Hydro, 20,371,664 kw; Internal Combustion, 2,110,434 kw; Steam, 59,568,119 kw; Total, 82,050,217 kw.



MAXIMUM CORRECTION REQUIRES SWITCHED CAPACITORS as tests on 70% pf feeder show low off-peak kvar requirements

Case Study Shows Savings Through

Power Factor Correction

Based on actual system survey, study shows effect of step by step increase in capacitor application and advantages of making installations on primary feeders

ALBERT R. WAEHNER, Manager, Sales Promotion, Line Material Co, Milwaukee, Wis.

Net annual savings of $72,380 can be made by installing static shunt capacitors on a Midwest utility system. This is based on the assumption that capacitors will be applied to the full extent permitted by system operating conditions. The $426,000 investment releases $897,000 of system investment and reduces losses by $25,280 per year.

This system has a minimum reactive requirement of 45,000 kvar, measured on a Monday morning between 2 and 5 am. It has already installed 18,000 kvar of static capacitors. But 27,000 kvar more can be added immediately as unswitched units without fear of swinging the generators to leading power factor at any time.

Maximum system requirement reached a peak of 750,000 kw and 506,000 kvar or approximately 83% pf. With 15,000 kvar in synchronous condensers, 12,000 kvar in high voltage cables and 18,000 in static capacitors, the generators had to supply 461,000 kvar. If 20% of peak kw demand was to be a starting goal, then 150,000 kvar of correction would be needed. This represents less than

one-third of peak kvar demand. Since the limit for off-peak generation is 45,000 kvar, the ratio of switched to unswitched capacitors should be approximately two to one. The economic analysis is based on this ratio.

Reduce System Load . . . The benefit of adding capacitors to 4-kv feeders is demonstrated by the diagrams at the right. If a total of 60,000 kvar is placed on 100 such feeders, system loading is reduced 36,000 kva as shown in the table. Losses were extrapolated from tests on a typical feeder. Generator load was calculated as the sum of load and losses.

Installing these capacitors would permit the entire load of 100 feeders to be supplied by 85. It also releases 22,000 kva of distribution substation and subtransmission capacity and 28,000 kva of bulk power system capacity.

Releases System Investment . . . Recent average installed costs of 4-kv feeders show that reduction in feeder investment by installation of 60,000 kvar of capacitors would be $171,000. Based on modern 4-kv unit type substations at $23 per kva, reduction in distribution substation investment would be $506,000. Recent cost studies of 26.4-kv supply lines show their value as $10 per kva; on this basis the savings would be $220,000. This gives a total reduction in investment of $897,000, not including the savings in bulk power and generating plant.

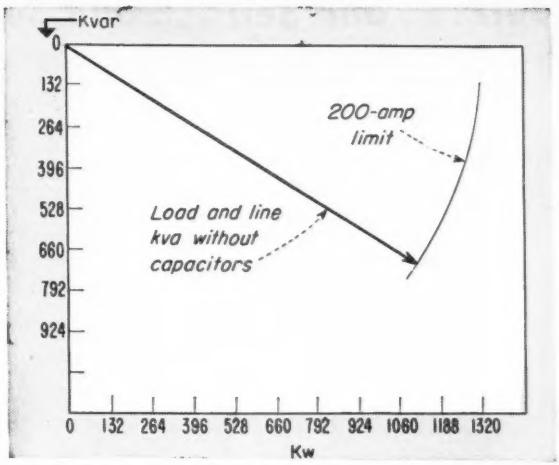
This company has accurate installed costs on unswitched banks at $5.03 per kvar. They estimate $8.13 per kvar on switched banks. Based on two switched units for each unswitched unit, the total installed cost of 60,000 kvar of capacitors would be $426,000. The difference in these two investments show a net gain of $471,000 which is more than the cost of the entire program. Evaluating the reduction in bulk power and generating plant at $150 per kw would add $630,000 to the gain.

It is planned to modify existing generators and to purchase all new ones with automatic regulators to permit stable operation at 95% leading pf. This would permit installation of a higher proportion of the capacitors unswitched. The net gain will be enhanced to the extent that this regulator program costs less than capacitor switches.

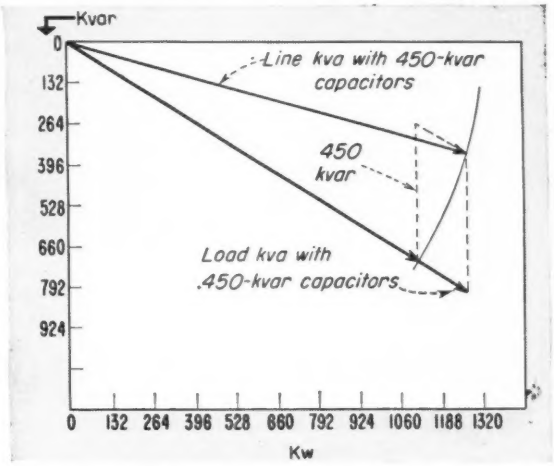
Lower Annual Cost . . . Installation of these shunt capacitors would reduce system losses also by 4.2 kw. If the energy is evaluated at 3 mills per kwhr, this constitutes a further saving of $25,280 per year. Taking $47,000 as the annual charges on the investment saved, this shows a total annual savings of $72,380 from adding 60,000 kvar of shunt capacitors to the distribution feeders.

Installing 60,000 kvar of Capacitors Cuts 4-kv Loads

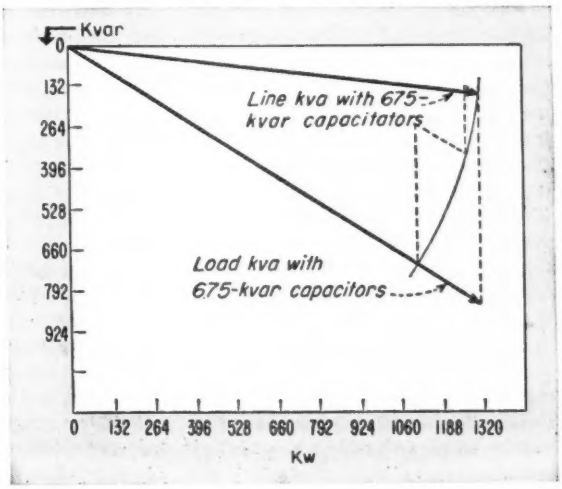
	Initial			With Capacitors		
	Mw	Mvar	Mva	Mw	Mvar	Mva
4-kv feeder load	112	69.5	132	112	69.5	132
Mvar supplied by capacitors	—	0	—	—	60	—
4-kv feeder loading	112	69.5	132	112	9.5	113
4-kv feeder losses	3.9	4.2	—	3.3	3.6	—
Load on Dist. Substa	115.9	73.7	138	115.3	13.1	116
S. S. and supply line losses	5.5	14.6	—	4.6	12.2	—
Load on bulk power system from 100 feeders	121.4	88.3	150	119.9	25.3	122
Bulk power system losses	6.8	14.0	—	4.1	8.3	—
Load on generators from 100 feeders	128.2	102.3	164	124.0	33.6	128



TYPICAL FEEDER LOADING of 1,320 kva at 85% pf reaches 200-amp limit at 3,810 volts



UNLOADED BY 450-KVAR CAPACITORS to 174 amps, feeder can carry 185-kva additional load within 200-amp limit



UNLOADED AGAIN BY 225-KVAR CAPACITOR to 195 amps, feeder can carry 46-kva more load. Combined gain is 17.5%

Sell . . . and Sell . . . and Sell

MORT FARR, Past President, National Appliance and Radio-TV Dealers Association

Retailers Can, and Will, Sell . . .

. . . if manufacturers, distributors and utilities discharge their responsibilities. Selling is a job for industry teamwork

Electricity in plenty, from high cost capacity installed at the expense of endless hours, labor, and dollars, must find its outlet in service to the public when military production and industrial plant expansion begin to taper off. Power to ease the housewife's lot, to run the electrical appliances of the nation, the hobby tools in the basement workshop, all the home conveniences that are plugged in—many times the quantity now in use—is the prospect that faces both dealers and utilities.

How to get these millions of new appliances and devices into the consumers' hands? Into regular use in the home? Why aren't they now selling as rapidly as they should, when savings are at a record high, production capacity is large and growing larger, employment is at its peak, and products have the strongest appeals they ever had both in value and performance? What can be done to speed the selling pace, to break the damaging log-jam in the economic cycle of production and consumption?

No easy answer exists here. No sounding-off of enthusiasm and listing of rosy objectives will bring them about. It's a multi-faceted problem all of whose aspects must be considered towards its solution.

Let's first consider the vehicles we have for reaching the consumers, the buyers of power-operated merchandise. In order of importance, they are:

Retail establishments, including specialty appliance and radio-television dealers, department and furniture stores, hardware stores and farm implement dealers, merchandising plumbers, and, to a lesser extent, mail order firms, credit jewelers, and drug stores.

Merchandising utilities.

Contractors and builders.

Miscellaneous outlets, such as factories that sell to their employees, group purchases made through credit unions and others, and direct sales by distributors.

Let's begin with the miscellaneous category. Almost invariably these outlets are parasitic. They supply merchandise to consumers who had already determined to make a purchase, and their appeal is entirely on the offering of a saving to the purchasers.

The contractors and builders install heating plants, water heaters, and, depending on local custom, perhaps ranges and refrigerators with most homes they sell. These purchases are made at very favorable prices and the products are usually sold at considerably below list prices and are included

in the mortgage. **There is considerable possibility that exceptional merchandise with powerful sales features could be added to these items, such as dishwashers, garbage disposer units, home laundries, and other products, particularly if the home is a high-priced one.**

Two rich opportunities present themselves in low- and medium-priced homes, the great majority of those now being built. The first lies in a friendlier relationship between the retailers and the contractors of the nation. By working together on zoning problems, tax reductions, simplified building codes and other activities that affect one or both fields, the pattern of teamwork can be established. Many of their legislative problems are common ones. Many of their areas of tension can be reduced by friendly discussion. The result could be the contractor channeling smaller-quantity and specialized purchases through the retailer and the dealer backing up the contractor's sales with good service.

Emphasis on Adequate Wiring

The second, and perhaps the most important, of these opportunities is an intensified and expanded drive to promote adequate wiring in every home in the community. Electrical contractors and dealers can jointly survey homes, for safety, for quality, for adaptability, and present to those home owners whose wiring is up to a certain optimum certificates which testify to the quality of that wiring. By concerted campaigns conducted through the building editors of newspapers, posters in store windows, references in dealers' individual and in jointly sponsored ads, the public and the financing agencies of a community can be trained to rank wiring high in evaluating property. Realtors can be induced to point out the extent and quality of wiring in their ads and sales presentations.

The fine promotional work that has been done on adequate wiring in the past can be raised to a new high in intensity and versatility, as a public is educated to recognize quality, is trained to ask, "What about the wiring?" when home purchases are being considered. The result: sales.

The merchandising utility can be a much more positive and dynamic factor in the appliance industry than it has been in recent years. Here, too often, poor public and intra-industry relations have failed to impress manufacturers and retailers alike with the all-important work these sales agencies do to create new markets and with the general cleanliness of their sales practices. It's difficult to envision how many commonly accepted products of today would have had their start were it not for the work of these merchandisers.

Today that work can be done on such low-saturation merchandise as dishwashers, garbage disposers, dryers, dehumidifiers, and many products which should have greater acceptance than they do. At least a score of the utilities I've visited are doing just that. The interchange of their success stories, of their most effective promotional literature and advertising through such bodies as the Edison Electric Institute, the Public Utilities Advertising Association, and the trade press are some of the sources of real, bright hope I have for the future.

The work of both merchandising and non-merchandising utilities with dealers is blotchy if you look at it from a national viewpoint. In San Diego, Los Angeles, New Orleans, Minneapolis, Washington, D. C., Nashville, Shreveport, many Wisconsin areas, most of the Indiana-Michigan territory, Pittsburgh and perhaps a dozen other communities, it is generally excellent and often brilliant. In others it is often neglected or badly mishandled. **Where teamwork and harmony can and should exist, as is so ably demonstrated in the areas cited, there is often tension, indifference or unawareness of reciprocal roles.** One of the most important functions of our national work with organized dealers —National Appliance and Radio-TV Dealers Association—is to supplant these unhealthy conditions with wholesome ones.

Now let's look at the most promising of the sales groups, the one with the greatest "gettable," to borrow an Amos Parrish term, the retail establishments. No longer are they dragging so much of the dead weight of lethargy imposed by past years of easy selling that destroyed their effectiveness during 1950 and through the forepart of 1952. Much of the deadwood has been eliminated. Those who survive have accomplished that survival by financial solidity, by earning a niche in the industry, and by having developed or recaptured a certain amount of selling power.

Distribution Readjustment

Electrical consumer goods distribution is going through a major period of adjustment and the appliance retailers of all types are bearing a large part of the brunt of it. The dealers are learning or have learned that excuses don't pay off in survival or growth, but that adaptability, intelligence, aggressiveness and sensitivity to local and national trends and market conditions do pay off in the sales that mean survival, stability and success, providing they're handled profitably.

The adjustments we dealers face are multiple:

1. Franchises are taking on real meaning again as major manufacturers try to build up their full-time teams and makers of single or few products try to develop retail specialists. This is erasing some of the unsavory competi-

Needed for a Healthy, Efficient Appliance Trade

1. **Elimination of cut-price, back-alley selling**
2. **Elevation of the appliance salesman's status**
3. **More intensive cultivation of markets**
4. **No more waiting for customers; go get them**
5. **Education of customers on trade-in values**
6. **Better balance in sales effort**
7. **Higher mark-ups**
8. **More emphasis on service**
9. **Removal of excise taxes on appliances**
10. **General improvement in integrity all along the line**

tion that some of the retailers have had to combat in recent years, and the retailers are learning that the erasure can be made permanent only by their delivering a reasonable percent of market to the brands to which they've pledged their loyalty.

2. Products are undergoing major interchanges in their relative importance. Laundry equipment is again becoming of great significance in the retailer's volume and the automatics are destined to be traded in more rapidly than were the conventional washers of the past. Air conditioners and dryers are on their way to becoming year-around merchandise sold for round-the-calendar use rather than for their emergency value dictated by weather conditions. Television is again entering a period of major expansion with the opening of new markets and the start of UHF, and another major opportunity looms in the late 1950's when color television will have attained substantiality. Freezers have proven their salability. The appliance business is no longer just the selling of refrigerators, ranges, and washing machines.

Electrical Housewares, Too

3. Small appliances, the products everyone can afford, everyone can use an extra of, and most dealers can afford to stock are again finding their place in retail operations. The passage of the McGuire Fair Trade Act is a major factor here. It's not enough for manufacturers to send out vast quantities of promotional literature and to map out campaigns for electric housewares. These materials and plans are simply not being used by the retailers of the country, although their quality and the thinking behind them is good. **Pressure must be imposed by manufacturers and their salesmen, distributors, and salesmen; utilities; trade groups; and the trade press to get this merchandise stocked, displayed, promoted, sold, and serviced.** There's no easy way out, no reason for not selling them today—and yet the job being done is far short of the gettable.

The old arguments about dealers being lazy, the statistics that show too many of them, the wild and promiscuous franchising, the cut-price selling techniques haven't done the job our industry needs and in no way have the potential of accomplishing the job. It would be presumptuous and arbitrary to try to blueprint a program of action that would accomplish it. There's no easy formula. But we can at least determine a series of actions that will lead toward this end and, perhaps, as we draw closer to our objective, the other steps we can take will become more clearly defined:

Things To Be Done

1. Bad practices must be stopped. The relief of discouragement, the elimination of back-door selling, the ending of conditions that cause the dealer who stocks, advertises, services, and promotes a brand of merchandise to lose sales to back-alley operators who offer price as their sole inducement, are necessary.

2. The appliance salesman's status should be raised. Local and national honors should be accorded the good ones; communities should be made acquainted with the service the salesman renders when he sells the washer that is right for a given housewife, the water heater that is sized to a family, the refrigerator that is budgeted to a family's earnings, the product that's just right for the prospect; prestige should be associated in every way possible with his work.

3. Markets must be cultivated more intensively. Prospect cards that give the dealer the complete story of a family's appliances allow him to anticipate their needs before present appliances actually becomes useless (the best method I know of countering cut-price competition). Such cards tell the minimum of appliances each customer in a given income bracket and family size should have and permit control of selling effort. If each salesman had 1,000 regular customers to whom he sold $200 worth of merchandise on the average each year, we'd all be better off.

4. Waiting for customers is out from now on. It must be supplanted by phone solicitation on a regular basis, by door-to-door selling, by significant advertising that causes customers to invite salesmen to call even if it doesn't bring them into the stores, and perhaps by opening of showrooms in heavy traffic areas, merchandise sold in these rooms coming from larger warehouses and service departments in lower-cost, neighborhood or outlying locations.

5. More intensive trade-in education is needed. Customers should be made aware of blue-book trade-in values, be told that old appliances should not take root in the home because their trade-in value drops as time goes on. Major styling trends, causing old appliances to look old, are a major factor in the trade-in picture. The architectural trend toward combining dining room and kitchen, permitting visitors to see the appliances, can prove most helpful here.

6. More diversified selling is essential. Retailers and their salesmen should be rewarded by manufacturers, distributors, utilities, and trade groups for keeping their sales in balance, between high and low saturation items and spread well among many types of products in each category.

7. Larger mark ups are needed. More realistic consideration should be given to the costs of doing business today and dealers thus given incentive for promoting harder. The lower the saturation of the item, the greater should be the profit incentive to selling it.

8. Greater emphasis must be put on service. All products should be sold in assured operative condition and drawing their share of load at the same time they create customer satisfaction. Dealer incentives to service can be stimulated by a sounder parts warranty system, by making service a franchise requirement, and by greater standardization of parts. At present the dealer must pay shipping charges on defective parts one or both ways, sometimes finds replacement of in-warranty parts very slow and has many other criticisms of the present arrangements.

9. Combined industry efforts are needed to reduce the tax burden. The 10% excise tax is inequitable and forces prices higher than they should be. Income taxes must be reduced as soon as possible, too, to permit the productive dealer to savor of his reward for productivity.

And, Most Important

10. Greater integrity is required at all levels, with loyalty, fairness, honesty, and teamwork restored to their old-time values and translated today to the betterment of the service our entire industry renders society.

It is for these purposes that dealers across the country are working together, both in their many excellent local organizations and in their national ones. And eventually, I have every confidence, they will create conditions convincingly favorable to electrical living in all American homes. It can be done.

5 Coffin Award Nominees Will Get Certificates

To accord greater recognition to the five electric companies which have been nominated for the Charles A. Coffin Award, the Charles A. Coffin Foundation will present each of them with a certificate of citation. The certificates will be sent out early in March by Bayard L. England, president of Edison Electric Institute.

The citation certificates are an innovation this year. In past years the five nominees received no formal recognition. As in the past the Coffin Award, which consists of a gold medallion and $1,000 for the company's employees' benefit fund, will be presented at the annual EEI convention in June.

The nominees are Arkansas Power & Light Co, Carolina Power & Light Co, Detroit Edison Co, Electric Energy, Inc, and Pennsylvania Power & Light Co.

Judges who will pick the winner are Dr James R. Killian, president of Massachusetts Institute of Technology; C. W. Kellogg, retired EEI president; and England.

Industrial Promotion Booklets Offered by EEI

Member companies of Edison Electric Institute who are interested in attracting industries to their territories have been offered two booklets by the institute.

The one, "Area Development Suggestions," depicts the various types and styles of direct mail pieces currently employed to encourage industries or their agents to address plant location inquiries to operating electric companies. It sells for 40¢.

The other is a check list for handling industrial prospects and locating new industries. It sells for 15¢.

Both publications have been prepared by the Industrial Development Subcommittee of the EEI Area Development Committee.

Ohio Power Co Given Award for Reforestation

Ohio Power Co has received the Ohio Forestry Association's Annual Forestry Award in recognition of its work in reforesting land that had been strip-mined and was unsuitable for agriculture.

Since the company started its land reclamation program in 1946, it has planted more than 3 million young trees on nearly 5,300 acres of mined and unmined land in Perry, Muskingum, Noble, and Guernsey Counties in southeastern Ohio.

John J. Reiser, New Philadelphia, Ohio, is in charge of the company's reclamation work.

Companies Asked to Aid PIP Speakers Bureau

Electric companies participating in the Public Information Program have been asked to cooperate with the newly organized Speakers Bureau. The bureau, which is being directed by Don Alexander, plans to supply electric utility industry speakers for national and regional meetings of other industries or groups. Speech topics would cover industry objectives.

Companies have been asked to have their top executives volunteer for assignment. PIP will make the arrangements for the scheduling of speeches and will supply data and other assistance if requested by the speakers.

PIP is now collecting copies of talks utility men are making locally.

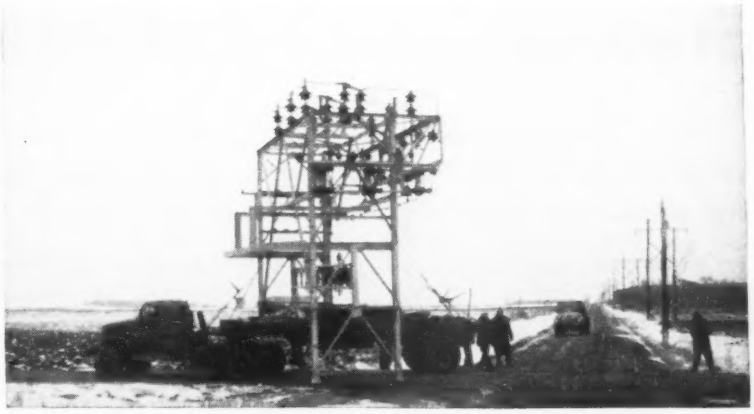
It is hoped that within a few months the bureau will be functioning with close to 50 top-ranking speakers ready for assignment at any meeting anywhere in the country.

Smith's Rifle Technique Informs Other Industries

Purcell L. Smith, president of the National Association of Electric Companies, has adopted the "rifle" approach in telling the industry's story to other industries. Instead of telling a general story to all other segments of the American free enterprise system, Smith now is writing magazine articles each directed to giving the electric companies story to one particular industry.

One of his recent articles was "Confidence Keynotes Electric Utilities" which appeared in "Trusts and Estates," a magazine circulated among banking firms. Other articles have been appearing in local Chamber of Commerce magazines which cover key business centers.

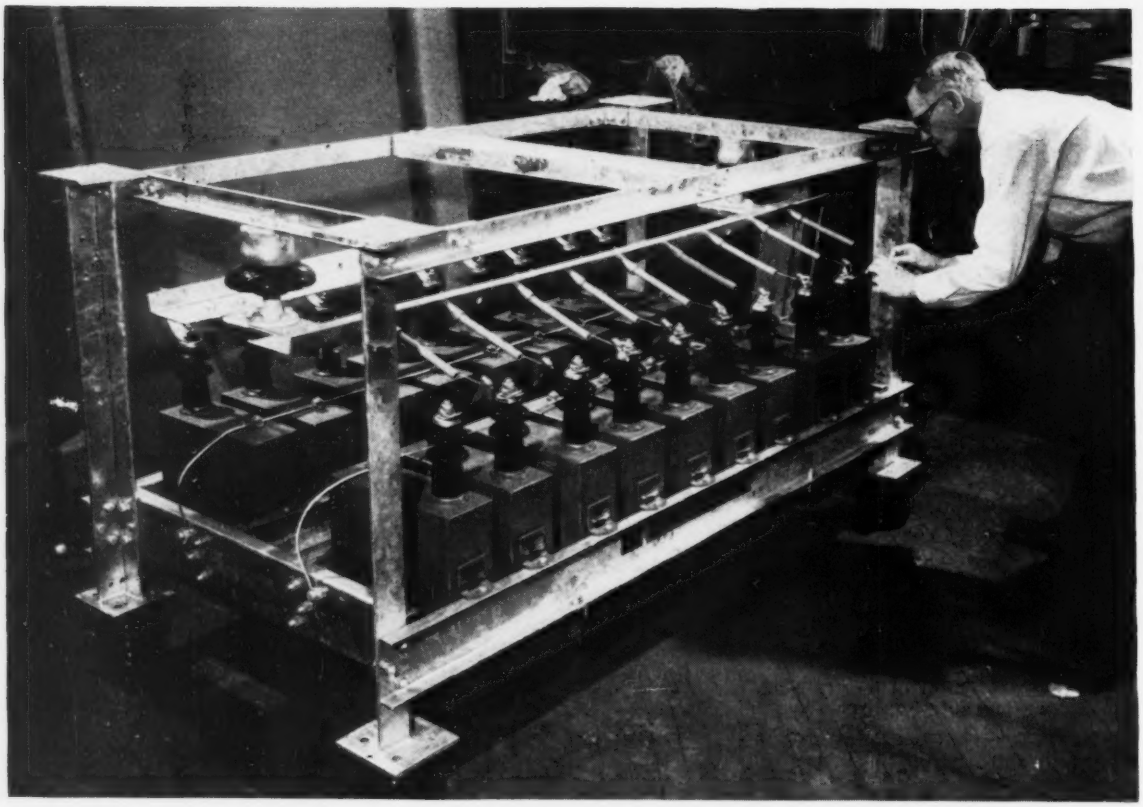
Reprints of typical articles addressed to business men are available from the National Association of Electric Companies, 1200 Eighteenth Street, NW, Washington 6, D. C.



Substation Goes for a Ride

A 69-kv substation of Minnesota Valley Cooperative Light & Power Association became a mobile unit for a brief while recently when it was moved one and a half miles to a new location. Instead of dismantling the structure, which measures 27 ft long, 15 ft wide, and 25 ft high, and moving it piecemeal, the substation was hoisted en masse on to a trailer truck.

The substation had been served by a 69-kv line owned by Northern States Power Co which was being converted to a 115-kv line by the company. A new 69-kv line was built leading to a different location where transformer pad, foundation, and anchor bolts had been constructed. The co-op substation was installed at this location. In the five-day interval a Northern States Power 1,500-kva mobile substation took over the load of the co-op substation.



STACKING UNIT having 18-25-kvar units—a total of 450 kvar. Arrangement is flexible, permitting different assembly positions of the stacks to suit dimensions of plot availab'e. Capacitor banks can be made up in a variety of voltage and kilovar ratings

Stacked Capacitors for High Voltage

New "packaged" capacitor stacking arrangement now permits "building block" standardization and flexibility for high voltage lines. Erection costs are reduced

R. E. MARBURY and W. H. CUTTINO

Capacitor Engineering, Westinghouse Electric Corp, E. Pittsburgh, Pa.

Two important factors causing the recent widespread use of capacitors are: More general recognition of the economic advantages of meeting kilovar requirements with capacitors; and advances in the design of both capacitors and the assemblies of capacitor units into convenient mountings.

Availability of 25-kvar units, with their lower cost and smaller volume and weight per kvar, was followed by pre-assembled banks for pole crossarm mounting. These greatly reduced installation expense and made for convenient installation of capacitor banks on distribution circuits up to 13.8 kv.

High Voltage Class . . . This "packaged design" with its ease of application and installation has been extended to cover the high-voltage class of capacitor installations. Now high-voltage shunt capacitor banks can be made up from standardized pre-assembled "stacking units," even for 110 kv or higher.

Prior to 1943 capacitors were rarely connected to circuit voltages higher than 13.8 kv. Since then, however, it has become common practice to assemble outdoor capacitor units in rows, supported on insulators, with phases consisting of series-parallel groups. These open-type banks have been quite satisfactory in service; however, cost of installation has been high because the steel structures required must be shipped knocked down necessitating assembly in the field. In addition, since requirements vary considerably, each installation must be specially designed and built.

Stacking Units . . . Now high-voltage capacitor banks can be made up in a variety of voltage and kilovar ratings, from the required number of pre-assembled stacked units. Such a typical "stacking unit" of 450 kvar consists of eighteen 25-kvar capacitor units and fuses, in a galvanized steel frame, as shown. When each phase leg of a capacitor bank is made up of three 24-unit assemblies in series, the total 3-phase bank rating is 5400 kvar, and if 4800-v capacitor units are used the bank can be connected to a 3-phase, 25-kv circuit.

Capacitor Groups . . . Where a large number of groups are to be connected

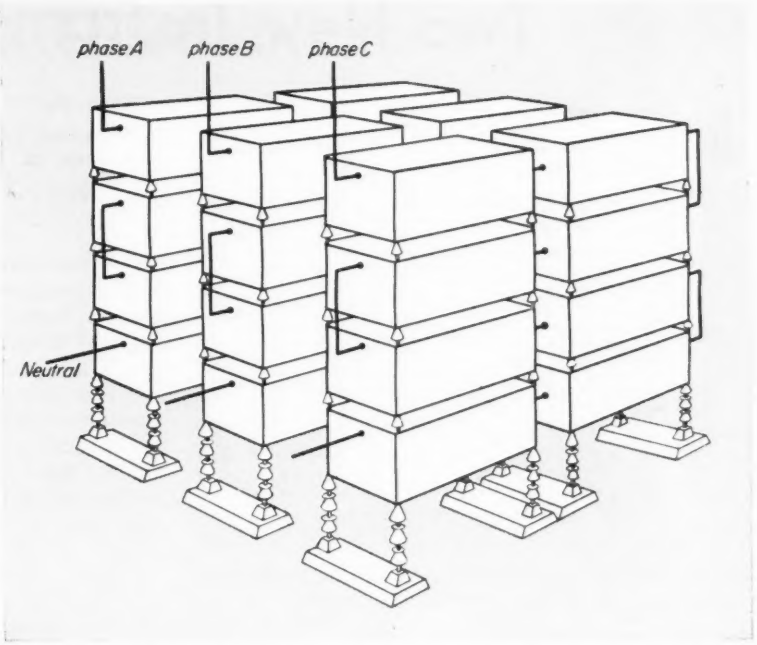
in series, two or more stacks can be used for each phase, and the connections made in zig-zag fashion so as to connect all the stacking units in series, as shown in the diagram. This avoids going higher than four tiers in a single stack, and also permits treating one stacking unit as a single capacitor. It is possible, however, to arrange the stacking units so that each row can be treated as a capacitor group. This connection is used on banks where the total kilovars per phase is small.

Specific Requirements . . . The only limitation in the assembly of high-voltage capacitor banks from series parallel groups of capacitor units is that certain specific requirements must be satisfied as follows:

1. The number of capacitor units in parallel in any one group should be large enough to provide adequate fuse current to insure positive blowing of the individual unit fuse and thus disconnect a faulty capacitor.

2. The number of capacitor units in a single group should be sufficiently large to insure that the change in voltage due to the operation of at least one fuse will not bring the voltage on the remaining units in the group above 110% which is the maximum continuous voltage rating of standard capacitors. The actual working voltage of the group should be equal or below the capacitor-unit rated voltage, in order to take full advantage of this 10% over-voltage range.

To meet these requirements, high-voltage capacitor units are often more desirable than low-voltage units. For example, if 2400-v units are used in a bank intended for 25-kv service, it will be necessary to use six groups of units in series, line to neutral. If this bank were comprised of 7200-v units, only two groups would be needed in each phase leg for a 25-kv line. When only two series groups are used the number per group can be as low as eight if the neutral is ungrounded.



STACKING UNIT assembly for 110-kv service has 3-phase rating of 14,400 kvar with 24-unit stacks using 25-kvar units. Base insulators match system voltage rating

Higher Voltage . . . The higher the line voltage, the more necessary it becomes to use higher-voltage capacitor units. These relations are shown in the table. The minimum kilovar values assume that the normal working voltage corresponds to the capacitor-unit voltage rating. Where the working voltage is above the unit rated voltage, as for example 105%, the minimum number of units in the groups must be greater, otherwise operation of a single fuse will result in voltages in excess of 110% on the remaining units in the group.

Advantages . . . Assembly of high-voltage banks from packaged stacking units has many advantages. The complete installation consists of a given number of stacking units plus the necessary base insulators to match the system voltage rating, spacing insulators when required, and connection material for making connections between stacking units. Base insulators can be mounted on concrete pillars or a structural-steel base sup-

(*Continued on page* 213)

Relations Between Line Voltage and Capacitor Unit Voltage

Unit Connections		Minimum 3-Phase Bank Kvar		Additional 3-Phase Kvar Steps		Line-to-Line Voltage Ratings				
Series Groups	Units Per Group	With 15-Kvar Units	With 25-Kvar Units	With 15-Kvar Units	With 25-Kvar Units	2400-v Units	4160-v Units	4800-v Units	7200-v Units	7960-v Units
1	6	270	450	45	75	4160	7200	———	12,470	13,800
2	8	720	1200	90	150	8320	14,400	16,640	24,940	27,600
3	9	1215	2025	135	225	12,480	21,600	24,960	37,410	41,400
4	9	1620	2700	180	300	16,640	28,800	33,280	49,880	55,200
5	10	2250	3750	225	375	20,800	36,000	41,600	63,350	69,000
6	10	2700	4500	270	450	24,960	43,200	49,920	74,820	82,800
7	10	3150	5250	315	525	29,120	50,400	58,240	87,290	96,600
8	10	3600	6000	360	600	33,280	57,600	66,500	99,760	110,400
9	11	4455	7425	405	675	37,440	64,800	74,880	112,230	124,200

Two New Instruments Measure

Instrument No. 1 measures actual light fluctuations

MARVIN FISHER, Jr., University of Illinois, Urbana, Ill.

V. H. KRAYBILL, Public Service Co of Northern Illinois, Maywood, Ill.

R. E. YOUNG, Public Service Co of Northern Illinois, Kankakee, Ill.

Two instruments have been developed recently to accurately measure fluctuating voltages, particularly those caused by welder loads: A lamp-phototube instrument that uses the variation in light intensity of an incandescent lamp bulb to measure rapid voltage fluctuations, and an instrument that provides a means of measuring the rms value of voltage for each half-cycle whether or not the wave forms are sinusoidal. These devices are useful in studying fluctuating voltages that may be produced by any type of changing load and in studying the effect of motor loads in reducing voltage fluctuations caused by welder loads.

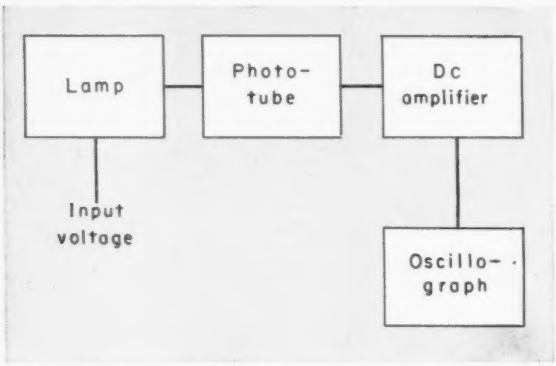


FIG 1—LAMP-PHOTOTUBE instrument includes dc amplifier and oscillograph. Actual flicker is measured by changes in light

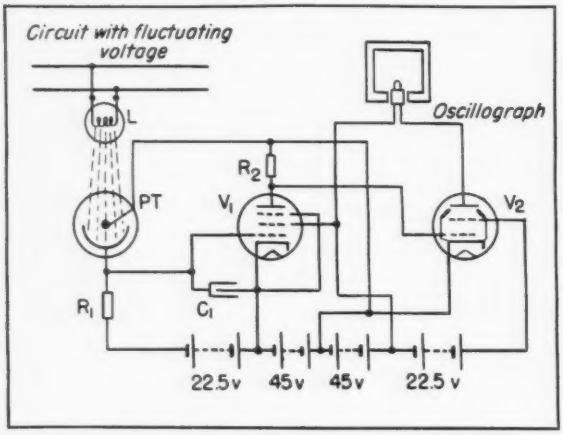


FIG 2—LAMP-PHOTOTUBE instrument connected to circuit to be tested. Voltage fluctuations are recorded by oscillograph actuated by phototube which responds to lamp flicker

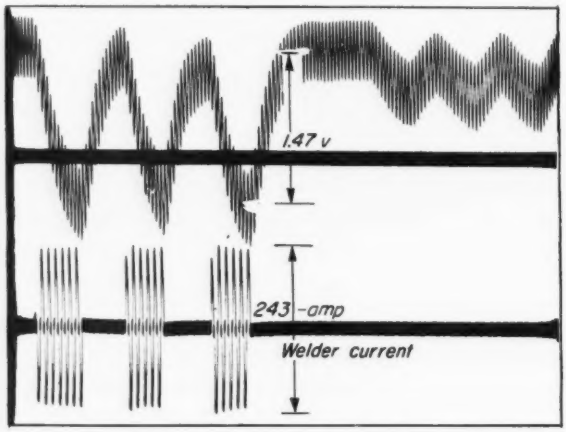


FIG 3—FLICKER caused by one welder is shown on oscillograph derived from phototube response to changes in lamp brightness. Voltage frequency is twice current frequency due to light fluctuations

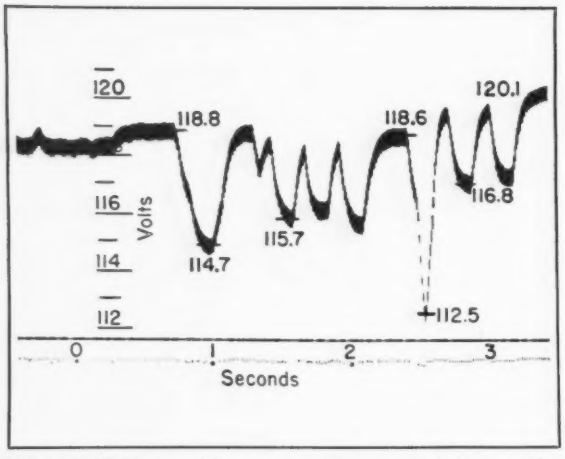


FIG 4—FLICKER caused by several welders is recorded on oscillograph through response of phototube to light from lamp

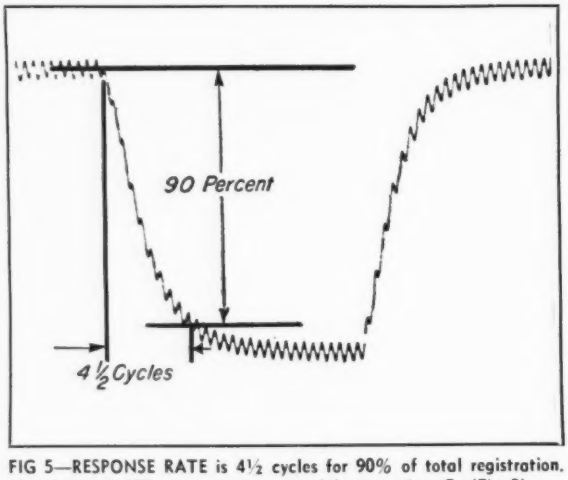


FIG 5—RESPONSE RATE is 4½ cycles for 90% of total registration. Magnitude of 120-cps wave is reduced by capacitor C_1 (Fig 2)

Rapid Voltage Fluctuations

Lamp-Phototube Instrument . . . Essential parts of the lamp-phototube instruments are: Lamp, to which the voltage to be measured is applied; phototube; dc amplifier; batteries; and oscillograph. The operation can be followed in Fig 2.

The lamp illuminates the phototube (PT) allowing current to flow through the phototube circuit causing a voltage drop across resistor R_1. This reduces the bias on the control grid of tube V_1 to a small value causing V_1 to become conducting. Current then flows through R_2, causing the control grid of tube V_2 to be biased negatively. With normal voltages applied to lamp (L) tube V_2 is biased almost to cut-off. Sufficient current is permitted to flow through V_2 to cause a small deflection of the oscillograph.

When a voltage drop occurs on the circuit being tested, reduced illumination on the phototube reduces phototube current flow. This reduces the voltage drop across R_1 causing the control grid of V_1 to be biased more negatively. This decreases current flow through the plate resistor R_2, reducing the bias on the control grid of V_2 which increases plate current of tube V_2 and causes an increase in deflection of the oscillograph. Capacitor C_1 partially filters out the 120-cycle component in the phototube current without noticeably slowing down the response time.

The device is calibrated by applying different values of voltage to the lamp (L) and noting oscillograph deflection. Adjustments can be made to the amplifier grid voltage bias by varying resistor R_1 so that full oscillograph deflection corresponds to a few percent of normal voltage. Several sensitivities are provided giving a range from zero to 16 v.

In general, the instrument gives accurate measurements of any voltage fluctuation lasting several or more cycles. This limitation is inherent in the type of sensing device used, i.e. the lamp, in which there is a thermal lag of the filament. Approximate values can be obtained for fluctuations of shorter duration by taking into account the response rate shown in Fig 5.

Within its limitations, the instrument has proved to be a very practical tool for measurement of fluctuating voltages. Good results have been obtained in measuring voltage variations caused by resistance and arc welding loads, arc furnace loads, and other large fluctuating loads as shown by typical oscillograms, Fig 3 and 4.

Field Tests With Phototube . . . Field tests were made in an industrial plant with the phototube instrument to determine whether the customer's proposed use of a resistance welder for seam welding operations would cause annoying light flicker for other customers served from the same feeder. The phototube meter was connected to the 2.4-kv single-phase line through a 20:1 transformer. Values obtained from oscillograms taken with the phototube device and calculated voltage drops are shown in the accompanying table.

Voltage Drops

Test No.	Plant Load Condition	Welder Load Current	Voltage Drop in 2.4-kv Supply During Weld	
			Measured Drop	Calculated Drop
1	Plant Motor Off.....	352 amp	1.95%	2.11%
2	Normal Plant Motors.....	343 amp	1.48%	1.63%
3	Maximum Plant Motors On..	349 amp	1.27%	1.15%

Measured voltage drops were made with lamp phototube measuring instrument.

Instrument No. 2 measures half-cycle rms voltages

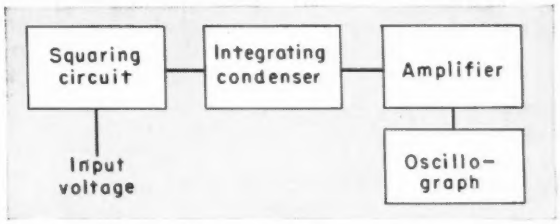


FIG 6—INSTANTANEOUS FLICKER instrument measures rms value of voltage for each half cycle, whether or not wave is sinusoidal

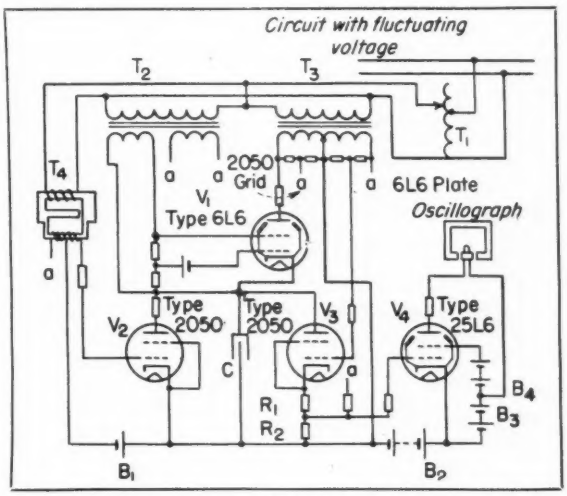


FIG 7—SIMPLIFIED WIRING DIAGRAM of instantaneous flicker instrument. Additional components are connected to terminals a

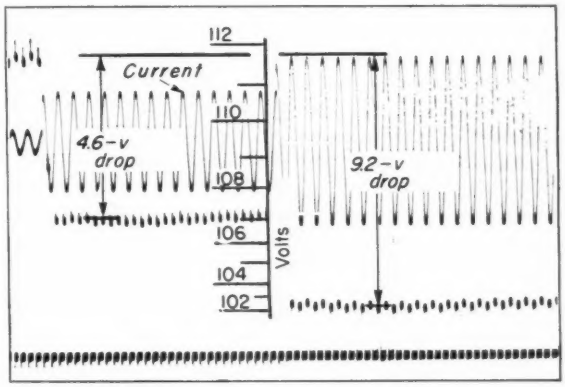


FIG 8—LABORATORY TESTS show results obtained in measuring flicker with instantaneous flicker instrument

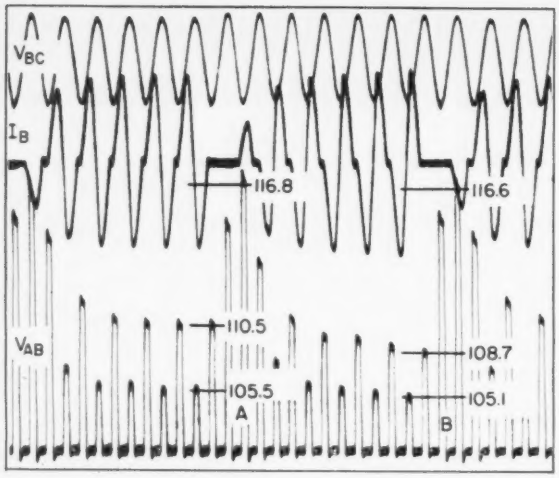


FIG 9—FLICKER VOLTAGE, V_{AB}, produced by a simulated three-phase welder was recorded. Motor load disconnected at P (Fig 11)

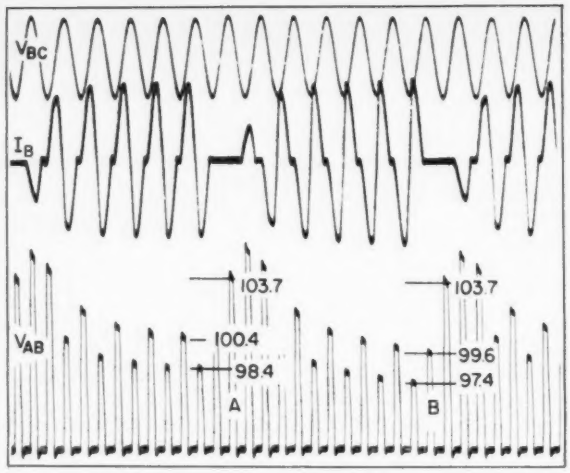


FIG 10—RECORD of flicker voltage obtained using instantaneous flicker instrument with motor load connected at P (Fig 11)

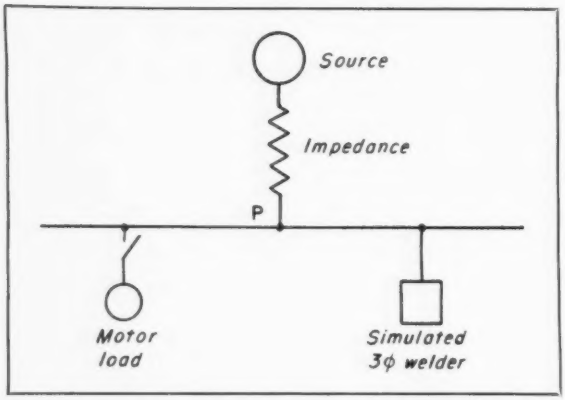


FIG 11—TEST CIRCUIT for determining effect of motors on the reduction of flicker voltage, measured with the flicker instrument

As indicated by the figures in the table, the phototube meter provided an accurate check of actual flicker conditions. By analysis of the oscillograms it was possible to distinguish accurately voltage variations caused by welder operation compared to variations due to other plant loads.

Instantaneous Flicker Instrument . . . The instantaneous flicker instrument, shown in block diagram in Fig 6, provides a means of measuring the rms value of voltage for each half cycle whether or not the wave forms are sinusoidal. It was developed to give a faster response than is provided by the lamp-phototube instrument.

The three-phase frequency changer resistance welder is an example of the type of fluctuating load that can be measured. Fluctuating voltages existing for only one cycle are too fast for measurement with the phototube instrument. Therefore, the flicker instrument has been used especially to determine the effect of motor loads on fluctuations caused by three-phase frequency changer welders.

The instantaneous flicker measuring instrument consists of two squaring and integrating circuits, an amplifier and an oscilloscope (Fig 7). One circuit measures the sum of the squares of the instantaneous values of voltage for each positive half-cycle and the other circuit measures values for each negative half-cycle. These values are recorded during the following quarter-cycles in each case. A change of a few percent in the voltage causes full-scale deflection of the oscillograph.

Fig 7 shows part of the instrument's circuit. The other squaring and integrating condenser circuit comprising tubes V_1, V_2, V_3, condenser C, a battery and resistors is identical to this one and is connected to the leads marked a. The input of the variable ratio auto-transformer T_1 is connected to the circuit on which the flicker is to be measured. It is used to adjust the voltage input to transformers T_2, T_3 and T_4.

One half of the secondary of transformer T_3 supplies plate voltage for the tube V_1. The values of the resistors in the secondaries of the transformer T_2 are such that in conjunction with the grid voltage versus plate current characteristics, the instantaneous values of current through tube V_1 varies as the square of the instantaneous values of the voltage being measured. This current charges the condenser C.

At the end of each positive half-cycle the control grid on the thyratron tube V_2 changes from negative to positive and the tube becomes conducting. The voltage existing across condenser C is thus impressed across the resistors R_1 and R_2. This voltage is in opposition to the grid bias voltage from battery B_2 and reduces the negative bias on the control grid of tube V_4 enough to cause it to become conducting. Plate current from tube V_4 will deflect the oscillograph. Both battery B_2 voltage and the opposing voltage are several times larger than the normal bias voltage of tube V_4. Thus full scale deflection can be obtained with a small change in the voltage being measured.

Transformer T_4 is constructed in such a manner that the secondary voltage will have a peaked wave shape. The battery B_1 puts a negative bias on the grid of tube V_2, preventing it from conducting. When the voltage from the secondary of T_4 overcomes this bias, tube V_2 becomes conducting, discharging condenser C very rapidly. With condenser C discharged, there is no current flow in resistor

(*Continued on page* 214)

WASHINGTON COMMENT

JESSE MOCK

Perhaps Not A Policy Change But Yet—

Relatively minor actions tend to loom large as bellwethers during these first few weeks of the Eisenhower administration. Attempts to seize upon these minor incidents and magnify them into vast policy changes appears almost ludicrous. Taken in perspective, however, they do offer some insight into the thinking of the government's new officials. They serve to make departures from the attitudes held by the men who ruled the previous administration.

Several of these actions affecting electric power agencies, for instance, would have been highly unusual under the old Truman reign.

Take the situation at Rural Electrification Administration:

When the Republicans reorganized the Agriculture Department, Romeo A. Short was put in charge of the credit agencies, which include REA. Short immediately called upon top REA officials—Administrator Claude Wickard, Deputy Administrator William Wise—to brief him on activity in the agency. These men, it turned out, were in San Francisco attending the annual convention of National Rural Electric Cooperative Association, lobbying organization for electric co-ops.

Result is that Short has asked for a list of all REA men attending the convention and a report on travel and headquarters expenses of the agency. There is, as yet, no indication how this information will be used. But it is the subject of considerable conversation among those on the staff of the agency.

Not Like in the Old Days . . . This is in sharp contrast to the treatment NRECA conventions have been accorded in the past. Last year President Truman sent one of his Cabinet, Interior Secretary Oscar Chapman, to the convention with a personal message—another attack on electric companies.

Or take Interior Secretary Douglas McKay's determination to act within the next few weeks on a proposed power contract with Georgia Power Co. This contract would provide for delivery of power from the government-owned Clark Hill Dam to users in Georgia (EW, Jan. 26, p 125). It could be described generally as a modified "wheeling" contract whereby the company would retain its customers.

McKay's predecessor toyed around with the contract more than a year before finally refusing to sign it on the grounds it did not measure up to established federal power policy.

Whatever McKay's decision on the contract may be, his determination to handle it promptly marks a memorable change in the affairs of the department.

An Insight into Official Thinking . . . Administrative reorganization—both that which has taken place at Agriculture and that which will take place at Interior—also gives an insight into the thinking of the new department heads.

Under the Democrats REA was treated with the exaggerated care shown the President's favorite child. Department of Agriculture, the parent agency, seldom bothered to discipline REA. Except for an integrated legal staff, REA was pretty much on its own.

Under the new setup, REA policies will get administrative review to make sure they conform with the department's overall policy.

At Interior, where Undersecretary Ralph Tudor will take over much of the administrative work, an attempt will also be made to coordinate the department's varied activities. Assistant secretaries will be the real bosses of the agencies under them.

This is a far cry from the zig-zag lines which have cluttered Interior's organization chart during the Truman administration.

None of these actions in their present status constitutes major policy changes. Unless they are followed by supporting actions strongly administered, they will remain of small significance.

But a start has been made. The Republican administration is gradually taking over control of the many federal agencies. By these small actions, lower echelon government workers are learning there are new bosses in the front office with ideas a lot different from the old ones.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Street-lighting, if utilities could start now, would probably be 85% multiple and 15% series rather than the reverse proportion which holds approximately now.

Globes for street lamps might well be plastic rather than glass but they would have to provide good light transmission as well as withstand temperatures up near 200 F.

Velocity of propagation of surges in the slot portion of 35 to 125 Mva turbine-generators has been reported to be 45 to 50 feet per microsecond.

Surge voltages experienced at generator terminals will be slightly higher if they arrive over cables connected to the high side of the step-up outgoing transformers as contrasted with bus.

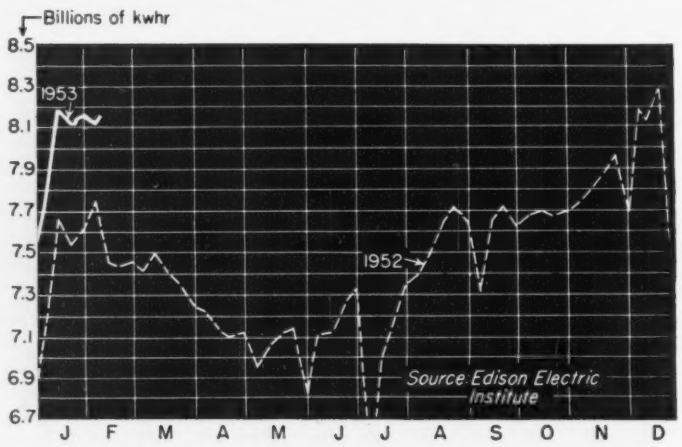
Attenuation to half-crest value will result for a 1½ x 40 wave after traversing about 6 miles of 120-kv high-pressure-gas pipe cable.

Distribution transformer secondary resistor method of alternator grounding makes no appreciable difference in the surge voltages appearing in the neutral when simultaneous surges are applied to all three phase terminals.

Incremental costs for various combinations of generating units can be put on a drum and turned quickly by the operator to determine the optimum choice.

Regenerators for gas turbines may bulk equal to 3 or even 4 boilers geared to supply an equivalent steam turbine. Regenerators, can, of course, be omitted when gas temperatures succeed in rising several hundred degrees above present limits.

STATISTICS



Output Week Ended Feb. 14—8,147,461,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Feb. 14	+9.5	+8.7	+7.0	+10.6	+10.0	+14.0	+5.3	+9.2	+5.1	+9.4
Feb. 7	+9.0	+10.4	+7.7	+9.7	+9.1	+11.4	+3.7	+10.1	+5.2	+10.9
Jan. 31	+7.6	+8.9	+6.0	+8.9	+7.1	+10.1	+5.4	+9.6	−0.1	+8.9

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Dec.	75.5	72.8	70.4
Capacity (Million Kw)	Dec.	82.05	80.91	75.54
Production (Billion Kwhr)	Nov.	33.75	34.82	32.10
Hydro		6.52	7.02	8.08
Fuel		27.23	27.80	24.02
Fuel Consumption				
Coal (Million Tons)	Nov.	9.93	9.92	9.74
Oil (Million Barrels)		7.75	7.16	5.96
Gas (Billion Cu Ft)		69.94	83.08	53.15
Sales (Billion Kwhr)	Nov.	30.08	30.15	27.92
Residential		8.16	7.72	7.37
Commercial		5.01	5.09	4.70
Industrial		14.91	15.16	13.89
Other		2.01	2.17	1.97
Net Income Class A & B Companies ($ Million)	Nov.	79.81**	64.86**	69.92
Estimated Dec. '53 Peak (Million Kw)	Nov.	87.3	87.2	88.3
Kwhr per Residential Customer (12 Month Average)	Nov.	2,155	2,143	1,988
Revenue per Kwhr Residential Service (12 Month Average)	Nov.	2.77¢	2.77¢	2.82¢
Canadian Production (Billion Kwhr)	Nov.	5.22	5.42	4.94

Business Statistics

FRB Industrial Production Index†††	Dec.	233*	235**	217
Gross National Product Annual Rate ($ Billion)	3rdQtr.	343.4	342.6	337.1
E. W. 5 Industry Production Index	Jan.	130.0*	129.8**	124.4
ENR Construction Cost Index††	Jan.	123.1	123.2	114.8
BLS Consumer's Price Index	Dec.	190.7	191.1	189.1
NEMA Insulation Materials Sales Index†	Dec.	655	579	466
NEMA Electric Appliance Sales Index†	Dec.	268	251	218
NEMA Household Refrig. Sales Index†	Dec.	147	152	115
Metal prices (Feb. 11)				
Copper, Conn. V., lb		$ .24½	$ .24½	$ .24½
Lead, N. Y., lb		.13½	.14	.19
Zinc, prime Western E. St. Louis, lb		.11½	.12½	.19½
Tin, Straits, qual. N. Y. lb		1.21½	1.21½	1.03
Aluminum, ingot, base price		.20	.20	.19
Nickel, base price		.56½	.56½	.56½
Steel, billets, Pitts., ton		59.00	59.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Preliminary ** Revised † 1936=100 †† 1949=100 ††† Unadjusted

Census Bureau Reports 4.6% Population Rise

The total population of the United States, including armed forces overseas, was about 158,012,000 as of November 1, 1952, according to estimates released during January by the Bureau of the Census. This figure represents an increase of 6,880,000, or 4.6%, over the corresponding estimate for April 1, 1950, the date of the last census.

Population of United States 1950

	Total	Urban Number	Urban % Total
NE	**9,314,453**	**7,101,511**	**76.2**
Me.	913,774	472,000	51.7
N. H.	533,242	306,806	57.5
Vt.	377,747	137,612	36.4
Mass.	4,690,514	3,959,239	84.4
R. I.	791,896	667,212	84.3
Conn.	2,007,280	1,558,642	77.6
MA	**30,163,533**	**24,271,689**	**80.5**
N. Y.	14,830,192	12,682,446	85.5
N. J.	4,835,329	4,186,207	86.6
Pa.	10,498,012	7,403,036	70.5
ENC	**30,399,368**	**21,185,713**	**69.7**
Ohio	7,946,627	5,578,274	70.2
Ind.	3,934,224	2,357,196	59.9
Ill.	8,712,176	6,759,271	77.6
Mich.	6,371,766	4,503,084	70.7
Wisc.	3,434,575	1,987,888	57.9
WNC	**14,061,394**	**7,305,219**	**52.0**
Minn.	2,982,483	1,624,914	54.5
Iowa	2,621,073	1,250,938	47.7
Mo.	3,954,653	2,432,715	61.5
N. D.	619,636	164,817	26.6
S. D.	652,740	216,710	33.2
Neb.	1,325,510	621,905	46.9
Kans.	1,905,299	993,220	52.1
SA	**21,182,335**	**10,391,163**	**49.1**
Del.	318,085	199,122	62.6
Md.	2,343,001	1,615,902	69.0
D. C.	802,178	802,178	100.0
Va.	3,318,680	1,560,115	47.0
W. Va.	2,005,552	694,487	34.6
N. C.	4,061,929	1,368,101	33.7
S. C.	2,117,027	777,921	36.7
Ga.	3,444,578	1,559,447	45.3
Fla.	2,771,305	1,813,890	65.5
ESC	**11,477,181**	**4,484,771**	**39.1**
Ky.	2,944,806	1,084,070	36.8
Tenn.	3,291,718	1,452,602	44.1
Ala.	3,061,743	1,340,937	43.8
Miss.	2,178,914	607,162	27.9
WSC	**14,537,572**	**8,079,828**	**55.6**
Ark.	1,909,511	630,591	33.0
La.	2,683,516	1,471,696	54.8
Okla.	2,233,351	1,139,481	51.0
Tex.	7,711,194	4,838,060	62.7
M	**5,074,998**	**2,785,888**	**54.9**
Mont.	591,024	258,034	43.7
Idaho	588,637	252,549	42.9
Wyo.	290,529	144,618	49.8
Colo.	1,325,089	831,318	62.7
N. M.	681,187	341,889	50.2
Ariz.	749,587	416,000	55.5
Utah	688,862	449,855	65.3
Nev.	160,083	91,625	57.2
P	**14,486,527**	**10,861,904**	**75.0**
Wash.	2,378,963	1,503,166	63.2
Ore.	1,521,341	819,318	53.9
Calif.	10,586,223	8,539,420	80.7
US	**150,697,361**	**96,467,686**	**64.0**

It is estimated that the total population reached almost 158½ million on January 1, 1953.

The advance reports of the 1950 Census of Population, released during December of 1952 indicate that the total population residing in the United States reached 150,697,361 in April of 1950. Of this total, 149,634,000 were civilians.

FINANCIAL

McLaughlin to Wait and See . . .

. . . what action is taken by Washington State legislature before selling Puget Sound Power & Light properties

With proposed sale of the Puget Sound Power & Light Co to a group of PUD's delayed indefinitely by court action, Puget's Pres Frank McLaughlin believes it "important to wait and see what changes in laws, if any, the present session of the Washington State legislature may enact which would affect Puget's position and policy."

The statement was included in a special letter to stockholders concerning the purchase and the alternative merger proposed by Washington Water Power Co. The letter was mailed out with the quarterly dividend check on the basis of 30¢ a share.

Conference Suggested . . . Answering a formal suggestion from Kinsey Robinson, president of WWP, that representatives of the two firms hold preliminary conversations to make possible the proposed merger, McLaughlin replied how can the Puget management be expected "to discuss merger terms when it has no merger proposal before it, and the matter of the extension of the PUD purchase agreement has not been resolved." He was referring to Robinson's action in withdrawing his latest merger proposal because McLaughlin refused to commit himself not to renew its sales contract with the PUD's beyond the expiration date of Feb. 27.

However, "Puget feels that the proponents of a merger should be given a reasonable period of time to demonstrate that a merger has the basic merit essential to its becoming a reality," said McLaughlin. "Efforts are being made at present to clarify the situation and to reach an understanding with WWP so that there will exist a basis for Puget representatives meeting promptly with those of WWP with respect to a merger."

Robinson, in his latest letter to McLaughlin, declared that "we are desirous of proceeding with the merger negotiations expeditiously and wish to continue exchanging with you information and data and to negotiate specific merger terms.

"We, of course, recognize that any action taken in this connection will be subject to your company's stated intentions fully to comply with its agreement with the PUD's so long as that agreement is in effect."

Cash on the Table . . . McLaughlin, in his letter to stockholders, intimated that it might be possible to renew the contract with a proviso for its termination "in the event of earlier disposition of the property to another party." Such a clause would permit Puget to carry on merger negotiations with WWP and allow it to sell to the first group able to put cash on the table.

Meanwhile, in the Washington State legislature, public power failed in an attempt to postpone indefinitely an anti-PUD measure. Motion of Rep John L. O'Brien, Seattle Democrat, was defeated 60-39 in a vote which is not regarded as a true test of the power question. However, a solid 58-member Republican house majority and two Democrats from Spokane, home of WWP, joined in blocking the O'Brien attempt.

Some known Republican public power supporters made it clear that they were voting on the principle that the measure, which would restrict PUD condemnation rights, should be given full consideration and then decided on its merits. Observers agree that the final vote will be very close.

The bill earlier had been approved by the House Public Utilities Commission by a margin of seven Republicans against four Democrats and one Republican.

Price of Electricity Will Go Up . . . Chauncey Price, president of the Washington State PUD association, contended that "the effect of all anti-PUD legislation would be to raise the price of electricity to consumers all over the state. It would make it more expensive for PUD's to do business and give private power companies the upper hand."

Price was given support by the Wenatchee Chamber of Commerce, which sent representatives to the legislature to protest against the anti-PUD legislation, "obviously being supported by an eastern Washington private utility." The legislation particularly would prevent the Chelan PUD of Wenatchee from condemning the Chelan generating plant of the WWP without first obtaining the approval of the state Public Service Commission.

"I believe that it is the responsibility of the Wenatchee C of C to fight for the economic future of this community, regardless of personal feelings on the subject of public versus private power," said E. O. Allen, president of the Wenatchee C of C.

Believes in Private Enterprise . . . "I am a firm believer in private enterprise and know that all the other chamber officers as well as the board of directors feel the same way, but when legislation is proposed that, if passed, would take away the local control of our power, we must do something about it.

"We have seen Grand Coulee power siphoned off by Spokane—we know that Chief Joseph power is programmed to go to the Puget Sound—and the only chance of using the power to develop payrolls in this area is through local control."

The Wenatchee C of C also passed a resolution declaring that interests of the community would best be served by PUD purchase of Puget rather than a Puget merger with WWP. It is particularly concerned with Puget's Rock Island Dam near Wenatchee, recently enlarged by the Chelan PUD.

"We believe local ownership and control of Rock Island Dam is more desirable than absentee control and that the effort of WWP to purchase the Puget company is not in the best interests of this community," said a C of C resolution.

Tacoma City Light Helps

When the municipal general fund at Tacoma, Wash., went into the red to the tune of $153,666 for 1952, Tacoma City Light came to the rescue. The City Council has just approved a resolution authorizing a $180,000 advance from the City Light fund to the general fund to cover the deficit. The money will be equivalent to estimated gross earnings tax of the light division for first quarter of 1953.

Kitsap PUD Chairman Wins Right to Hold Job

J. W. Bryan, Sr, chairman of the Kitsap County PUD and outspoken foe of the proposed PUD purchase of the Puget Sound Power & Light Co, won his right to continue in office when the Kitsap County Superior Court at Port Orchard, Wash., dismissed a suit challenging his right to serve as a commissioner.

Judge Henry Clay Agnew held that PUD sub-district boundaries conform with boundaries of the county road districts and changed automatically with a shift of the road district boundaries in 1950.

Prosecutor John C. Merkel, who filed a motion for a new hearing, contended that the PUD law requires specific, formal action by PUD commissioners to change a boundary. He contended that Bryan's residence was in another district than that from which he was elected to the PUD commission.

FINANCIAL BRIEFS

Electric Bond & Share Co has announced that with the disposal of its 60,543 common shares of Washington Water Power Co to Blyth & Co recently, EB&S for the first time in its 48-year history no longer holds any securities of any electric company operating in the U. S. . . . **Detroit Edison Co** has sold $24 million general and refunding mortgage 3.2% bonds due 1973 to institutions headed by Bankers Trust Co . . . **Arkansas Power & Light Co** has purchased a city block in downtown Little Rock on which it will construct an office building . . . **Wellington Fund** annual report for 1952 shows that it had common stock investments in electric companies totaling $19,265,750 at the end of 1952 as compared with $17,907,250 at the close of 1951.

Gulf States Utilities Co is planning to issue an additional share for every four common shares now held. Pres Roy S. Nelson has announced. The company is considering maintaining the present 30¢ quarterly dividend on the increased number of shares . . . **Commonwealth Edison Co** showed net income of $33,463,970 in 1952, equal to $2.25 a common share as compared to $26,754,689 in 1951, or $1.93 a share in 1951.

Today in Utility Finance

YIELDS (%)

Quality	Bonds 1st	Bonds 2nd	Bonds 3rd	Preferred Stocks 1st	Preferred Stocks 2nd	Preferred Stocks 3rd	Common Stocks 1st	Common Stocks 2nd	Common Stocks 3rd
DATE									
1953									
Feb. 11	**3.08**	**3.13**	**3.21**	**4.14**	**4.29**	**4.60**	**4.97**	**5.33**	**5.72**
Feb. 5	3.07	3.12	3.19	4.11	4.26	4.58	4.96	5.30	5.65
END OF QTR:									
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.59	5.96
2nd 1952	2.95	3.00	3.09	4.05	4.31	4.60	5.38	5.85	6.42
1st 1952	2.95	2.99	3.13	4.11	4.29	4.66	5.35	6.03	6.47

Data: Reis & Chandler, Inc.

EARNINGS—Preliminary

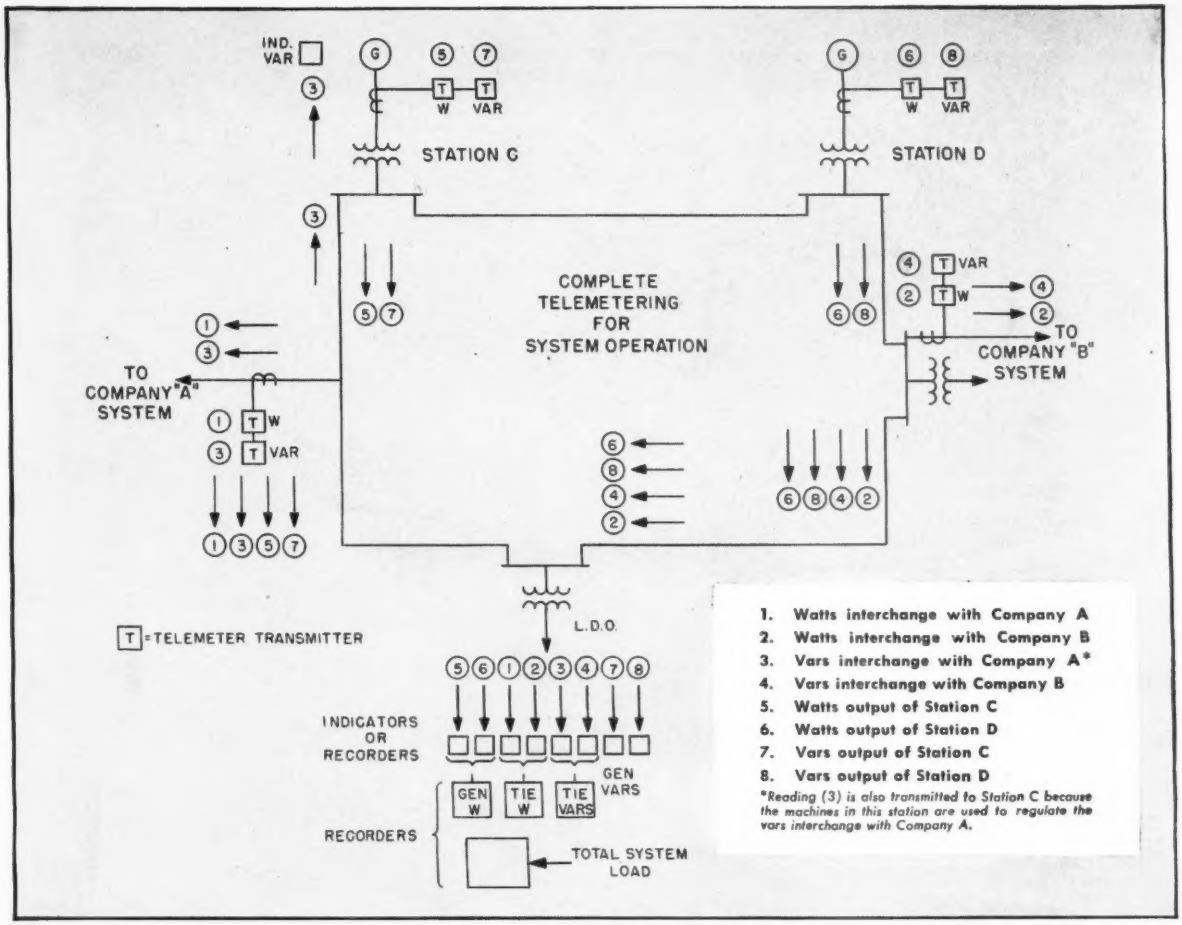
Company	Period Months Ended		Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
Arkansas Power & Light	12	Dec.	$6,270,951	$4,668,327	$....	$....
California Oregon Power	12	Dec.	2,617,258	2,338,100	1.69	....
California-Pacific Utilities	12	Dec.	538,153	480,043	2.02	1.79
Dallas Power & Light	12	Dec.	4,354,163	3,315,365	....	....
Mississippi Power & Light	12	Dec.	3,591,766	3,174,561	....	....
New York State E&G	12	Dec.	7,477,155	6,290,246	2.38(a)	2.18(a)
Pacific Power & Light	12	Dec.	4,413,702(b)	3,596,321	....	....
Texas Electric Service	12	Dec.	8,256,636	6,528,067	....	....
Texas Power & Light	12	Dec.	7,460,736	6,104,456	....	....

Notes—(a) Based on 2,696,950 shares in 1952 and 2,396,950 shares in 1951; (b) Includes $1,208,685 of "accrued surcharges" and $261,848 of surcharges already billed, which together represent the $1,470,533 of recoverable excess steam costs for the months of September through December, 1952.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF FEBRUARY 12-18			
Bonds			
Consolidated Edison Co of New York—1st mtg 3½% due 1983	$40,000	$102.25	3.38%
Iowa Southern Utilities—1st mtg 3⅜% due 1983	7,000	102.60	3.73
Niagara Mohawk Power—1st mtg 3½% due 1983	25,000	101.75	3.41
Common Stock			
Niagara Mohawk Power—1,000,000 sh	$27,500	$27.50	5.82%
South Carolina Electric & Gas—358,045 sh (being offered to commonholders on 1-for-7 basis, record Feb. 18 to expire Mar. 4; stockholders to be allowed oversubscription privileges)	4,297	12.00	5.83
SCHEDULE FOR MARCH			
Bonds			**Bid Date**
Indianapolis Power & Light—1st mtg	$10,000	.....	Mar. 3
Fall River Electric Light—1st mtg due 1983	6,800	.....	Mar. 9
Narragansett Electric—1st mtg due 1983	10,000	.....	Mar. 10
Central Maine Power—1st general mtg due 1983	10,000	.....	Mar. 10
Lake Superior District Power—1st mtg	2,000	.....	Mar. 16
Public Service Co of Oklahoma—1st mtg	6,000	.....	Mar. 17
Mississippi Power & Light—1st mtg due 1983	12,000	.....	Mar. 17
Georgia Power—1st mtg due 1983	16,000	.....	Mar. 24
Dallas Power & Light—1st mtg	9,000	.....	Mar. 24
Preferred Stock			
New England Power—80,140 sh $100 par (to be first offered to holders of outstanding 6% pfd on share-for-share basis about Mar. 3 to Mar. 23)	8,014	.....	Mar. 3
Public Service Co of New Mexico—30,000 sh $100 par	3,000	.....	Mar. 17**
Georgia Power—100,000 sh no par	.....	.....	Mar. 24
Common Stock			
California Electric Power—136,249 sh	.....	.....	Mar. 31
Southern Indiana Gas & Electric—114,167 sh (to be offered to commonholders on 1-for-6 basis, record Mar. 25 to expire April 10)	.....	.....	.....
Lake Superior District Power—29,761 sh (to be offered commonholders on 1-for-9 basis record about Mar. 6 to expire Mar. 23; Robert W. Baird & Co underwriters)	.....	.....	.....
Arizona Public Service—about 378,000 sh	.....	.....	.....#
Southern Co—about 1 million sh (to be offered to commonholders on 1-for-17 basis, record about April 16 to expire May 7)	.....	.....	.....
Public Service Electric & Gas—750,000 sh	.....	.....	Mar. 18##
UNSCHEDULED AND UNDER CONSIDERATION			
Bonds			
Rockland Light & Power—1st mtg	$5,500	.....	.....
Wisconsin Public Service—1st mtg	7,500*	.....	.....
Monongahela Power—1st mtg	10,000	.....	.....
Arkansas Power & Light—1st mtg	18,000	.....	.....
Louisiana Power & Light—1st mtg	10,000	.....	.....
Texas Power & Light—1st mtg	11,000	.....	.....
Public Service Electric & Gas—1st mtg	50,000	.....	.....
Jersey Central Power & Light—1st mtg	8,500	.....	.....
Metropolitan Edison—1st mtg	8,000	.....	.....

Notes—* Estimated. ** To be offered by Allen & Co, underwriters. # It is expected to be offered during the week of Mar. 9 by First Boston-Blyth & Co group, underwriters. ## Morgan Stanley & Co group will probably offer the stock.


IND. VAR
STATION C
STATION D
COMPLETE TELEMETERING FOR SYSTEM OPERATION
TO COMPANY "A" SYSTEM
TO COMPANY "B" SYSTEM
T=TELEMETER TRANSMITTER
L.D.O.
INDICATORS OR RECORDERS
GEN VARS
GEN W
TIE W
TIE VARS
RECORDERS
TOTAL SYSTEM LOAD
1. Watts interchange with Company A
2. Watts interchange with Company B
3. Vars interchange with Company A*
4. Vars interchange with Company B
5. Watts output of Station C
6. Watts output of Station D
7. Vars output of Station C
8. Vars output of Station D
*Reading (3) is also transmitted to Station C because the machines in this station are used to regulate the vars interchange with Company A.

G-E Telemetering Provides Immediate Check of Entire Power Generating System

Above is a complete telemetering network for one generating system. The diagram shows how this network instantly supplies system load dispatches with eight essential checks on power generation.

Only continuous, system-wide telemetering can bring you all of these essential readings: active and reactive power in the tie lines and other key points, generating station power and reactive power, loading of critical tie lines, and net power interchange.

G-E telemetering equipment is available for carrier-current channels, microwave channels and wire-line channels. You are assured of a completely co-ordinated system because all the equipment is designed, manufactured, sold, and serviced by only one company.

FAST RECORDER RESPONSE is available from the G-E telemetering system. With any nominal two-second electronic system, the response time is less than two seconds for 90 percent of full scale. Accurate indications or records of even rapidly fluctuating voltages or loads can be obtained.

Also, because indicating milliammeters can be used when a record is not needed, the expense of charts and maintenance of narrow or wide chart recorders is limited to those places where recording is essential.

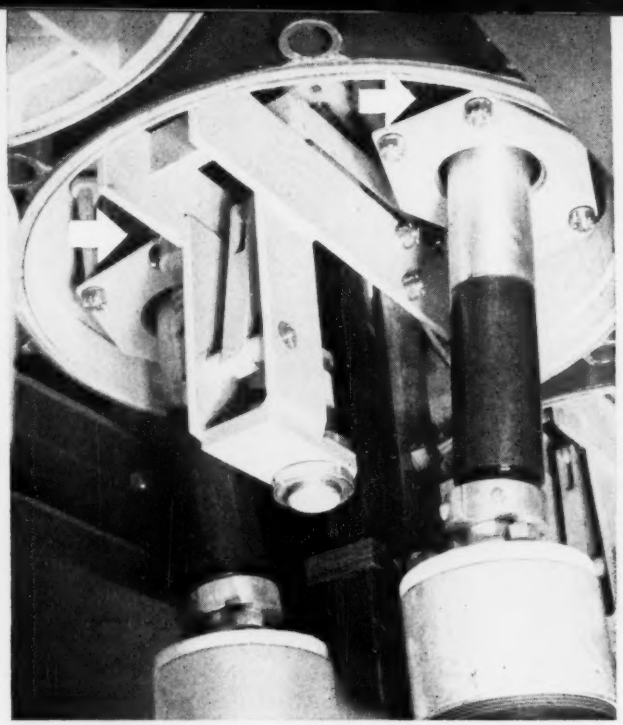
LOW INITIAL COST is incurred with the G-E carrier-current system. Only 11 under-rated tubes (not including the recorder) are used, compared with more than 30 tubes, without recorder, in other systems. This means less initial cost and maintenance without sacrifice in accuracy or reliability.

MORE INFORMATION is available about G-E telemetering systems. Contact your nearest G-E apparatus sales office, or write for Bulletin GEA-5746, General Electric Co., Section 605-38, Schenectady 5, N. Y.

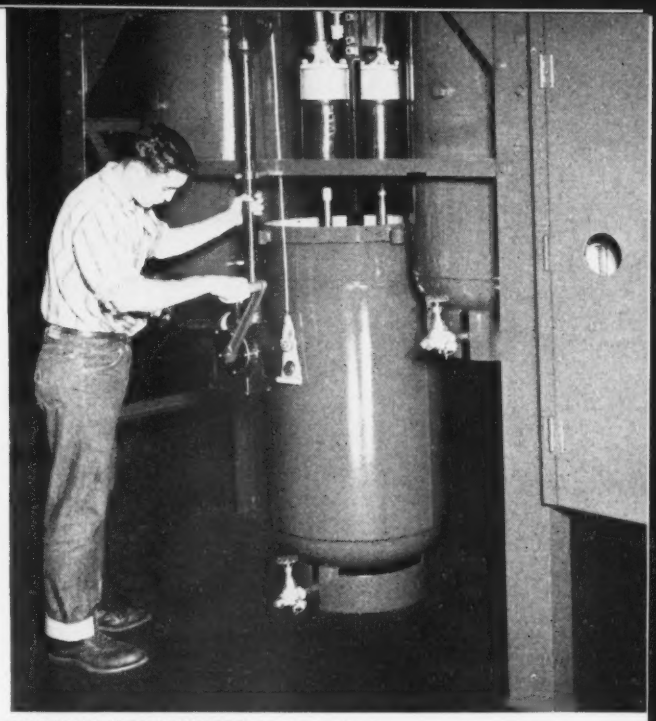
You can put your confidence in—

GENERAL ELECTRIC

NEW BREAKER, shown here assembled on factory floor, is designed so that all parts are easily accessible for inspection or maintenance. Positive indicating mechanism makes it easy to see breaker position (open or closed) from any angle.



TWO CURRENT TRANSFORMERS provide extra metering when needed. New design provides room for installation of two transformers *on each bushing* as shown.



TANKS MAY BE LOWERED in the field for easy access to bushings and contacts. This makes it unnecessary to drain oil during inspection or maintenance.

New G-E breaker interrupts with shorter arc to cut oil maintenance

New design features improve reliability, simplify maintenance

Improved service reliability and reduced need for inspection and maintenance are the outstanding advantages of the new Type FK-439 and 1200-ampere outdoor power circuit breakers.

New oil-blast interrupters cut oil carbonization by interrupting faults or load currents with short-arc lengths and low-arc energy. Silver-molybdenum surfaces on the interrupter contacts insure minimum erosion. As a result, fewer inspections will be found necessary, and oil maintenance requirements may be substantially reduced.

Contributing to greater reliability in service is a new, sturdy oil-filled bushing, Type LC. It is of center-clamp construction, thus eliminating all cemented joints. Lower ends of bushings are given a special coating to reduce the electrostatic deposit of carbon particles. This means even less maintenance. Space is provided for two current transformers on each bushing.

The new Type FK-439 breakers are powered by an improved pneumatic operating mechanism, which employs a simple pneumatic trip-free linkage design, completely eliminating the need for a flying latch. Simplified support framework, float-type oil gauge and more accessible pole-unit linkage are among the many detail improvements. For full information, call your local G-E sales representative or write to General Electric Company, Schenectady 5, N. Y. 872-1

GENERAL ELECTRIC

Bartlett Tree Expert Co

HELICOPTER SPRAYER BOOM has multiple nozzles that can be closed or opened to vary width of swath. Operator is filling chemical tank

Brush Spraying Cost Halved by Helicopter

L. M. DONAHUE, Transmission Supt, Central Vermont Public Service Corp, Rutland, Vt.

Use of a helicopter, equipped with chemical tanks and spray nozzles, has reduced Central Vermont Public Service Corp's brush spraying costs 50%. Results of 2-yr experience and 900 acres sprayed with this method of application show that complete line coverage and penetration are obtained. In addition, the problems of transporting chemical to troublesome places by truck and obtaining even distribution of spray material of the right-of-way have been eliminated.

Equipment . . . During the two years CVPS has used the helicopter sprayer, some improvements have been made in the spray equipment. In the 1951 operation, two tanks were fastened to the helicopter with two, 6-in. diameter, application tubes extending back from the spray tanks about 3 ft. This put the discharge ends of the tubes directly in the down-draft of the rotor blades, which accelerated the mixture downward and gave good penetration. The mixture applied was 1.5-gal of chemical to 5.5-gal of oil.

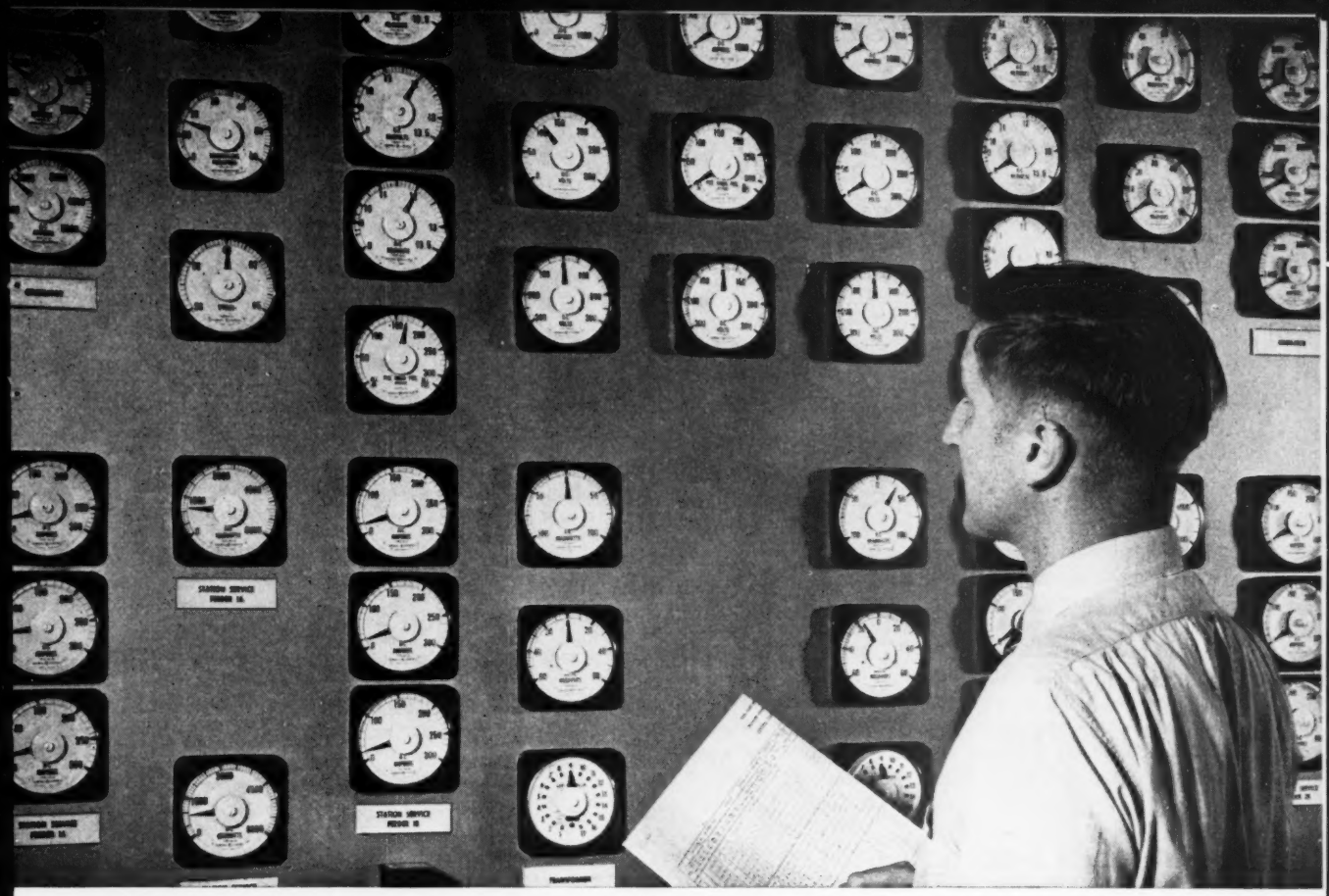
Equipment used in 1952 differed in two respects from the previous year. First, the discharge tubes were replaced with a spray boom that had numerous nozzles. This permitted the company to vary the swath's width by varying the number of nozzles used. The second difference from the first year's spraying operation was that in some areas the 1.5-gal of chemical was mixed with 5.5-gal of water instead of oil.

Procedure . . . The helicopter method calls for very careful operation and planning for spraying. No work can be done when wind blows, as this would cause the mixture to blow away from the desired spots, endangering adjacent trees and wasting chemicals. CVPS has found that the best time for spraying is the first 2-hr of daylight and the last 2-hr before dark.

Good coverage was obtained on 100-ft right-of-ways by making five passes over each section, flying at the rate of 40 mph at an elevation 10 ft above the conductors, which is about 50 ft above the earth. On right-of-ways 150-ft wide it required seven passes. For good control, 7-gal of chemical mixture per acre were used to cover areas where the brush varied in height from four to eight feet and in most cases was quite dense.

The right-of-ways sprayed included those for 44-kv and 66-kv lines. These lines were de-energized during the spraying operation to insure maximum safety for the pilot and helicopter.

Tests on transmission line equipment indicate that insulators, conductors and hardware are not damaged by the chemical. Flash-over tests of energized conductors have also been made and prove conclusively that the mixture can be sprayed on energized lines, if it were not for the previously mentioned safety angle.

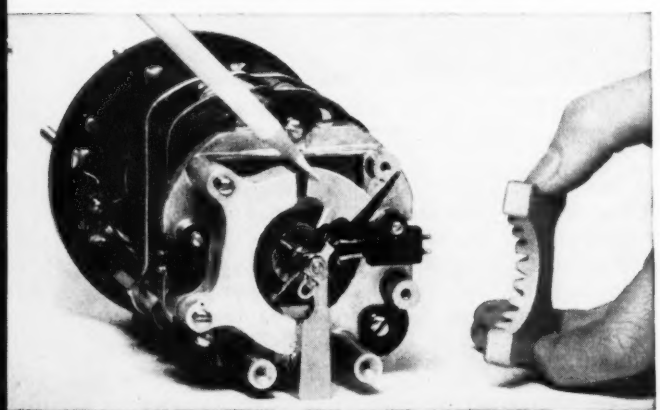


OPERATORS TAKE READINGS QUICKLY AND EASILY WITH GENERAL ELECTRIC TYPE AB-18 SHADOW-PROOF SWITCHBOARD INSTRUMENTS

G-E Long-scale Instruments Provide Improved Repeatability, Sturdiness

Now you can be assured of dependable, accurate, and consistent readings with G-E switchboard instruments. These small-sized instruments are for general service on both large and small equipment, such as control stations, testing devices, and other installations where space is limited.

REPEATABILITY is obtained with G-E long-scale instruments because they are magnetically damped to give consistent readings. You get the same reading time after time.



UNIFORM MAGNETIC DAMPING for full-scale operation permits fast pointer response without overshoot and cuts down pivot wear.

STURDINESS is obtained from strong cast-aluminum frames and shafts. The expansion rates being the same, pivots are prevented from coming loose or jamming. The one-piece, all-metal scale plate withstands abnormal humidity and temperature conditions.

SHADOW-PROOF COVER assures you of easy readability. Cover overhang and overhead-lighting shadows are eliminated because the dial is set flush with the front of the case A protruding convex-glass cover gives all-around illumination, which assures legible figures.

COMPLETE INSTRUMENT LINE is available. You can get G-E shadow-proof instruments in both 4¼-inch (Type AB-18) and 8¾-inch (Type AB-16) sizes. Available as ammeters, voltmeters, and wattmeters; frequency and power-factor meters; temperature indicators and synchroscopes.

FOR MORE INFORMATION write or call your nearest G-E apparatus sales office. Write for Bulletin GEC-218, General Electric Co., Section 602-251, Schenectady 5, N. Y.

You can put your confidence in—

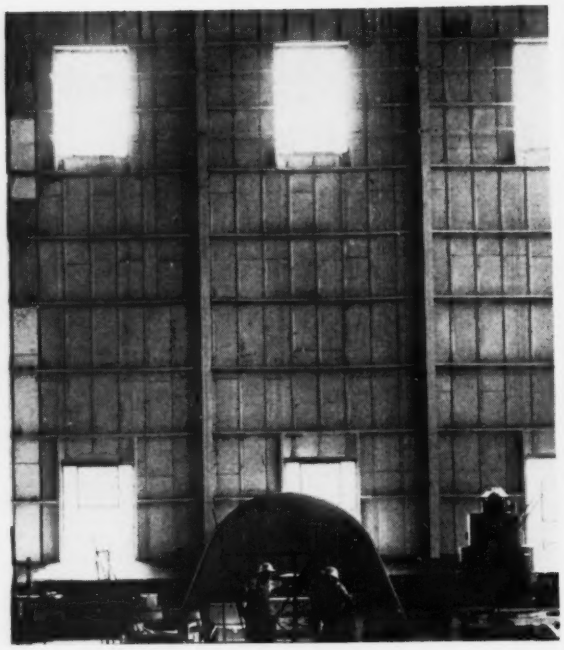
GENERAL ELECTRIC

Crane Moves Wall in Station Expansion

When Louisville Gas and Electric Co added unit 6 to its Paddy's Run Station the overhead crane was used to lift the end wall from its position at the completion of work on unit 5 and move it to the new position, a distance of 110 ft. The wall consisted of standard structural steel columns and channel girt framework covered with Q panel siding. It extended from about four feet above the main floor to the roof between the main crane columns.

Preliminary work consisted of removing the curtain wall at the main floor to expose the column splices and removing one section of siding along the top near the roof girder to provide necessary clearance so that the wall would pass the existing structural members.

Structural beams were then placed on the overhead crane framework cantilevering out far enough to pick up the load of the wall. The load of the wall was transferred to the beams using a lashing and turn buckle. When the load was suspended, it was lifted slightly, structural steel connections were released and the crane was moved slowly to the new location where structural connections were remade and the sections of siding replaced.



WALL OF STRUCTURAL STEEL COLUMNS and channel girt framework, covered with Q panel siding, was moved to new location with overhead crane. Job was part of station expansion program

Aluminum Bodies Cut Truck Fleet Costs

Operation of a truck fleet having 21 steel bodies and 25 aluminum alloy bodies under comparable conditions during the past four years has permitted Dayton Power and Light Co to draw some interesting conclusions. With the aluminum bodies there is no corrosion, no painting inside, operating costs have been reduced and the lighter weight bodies permits the use of smaller motors for the same truck size.

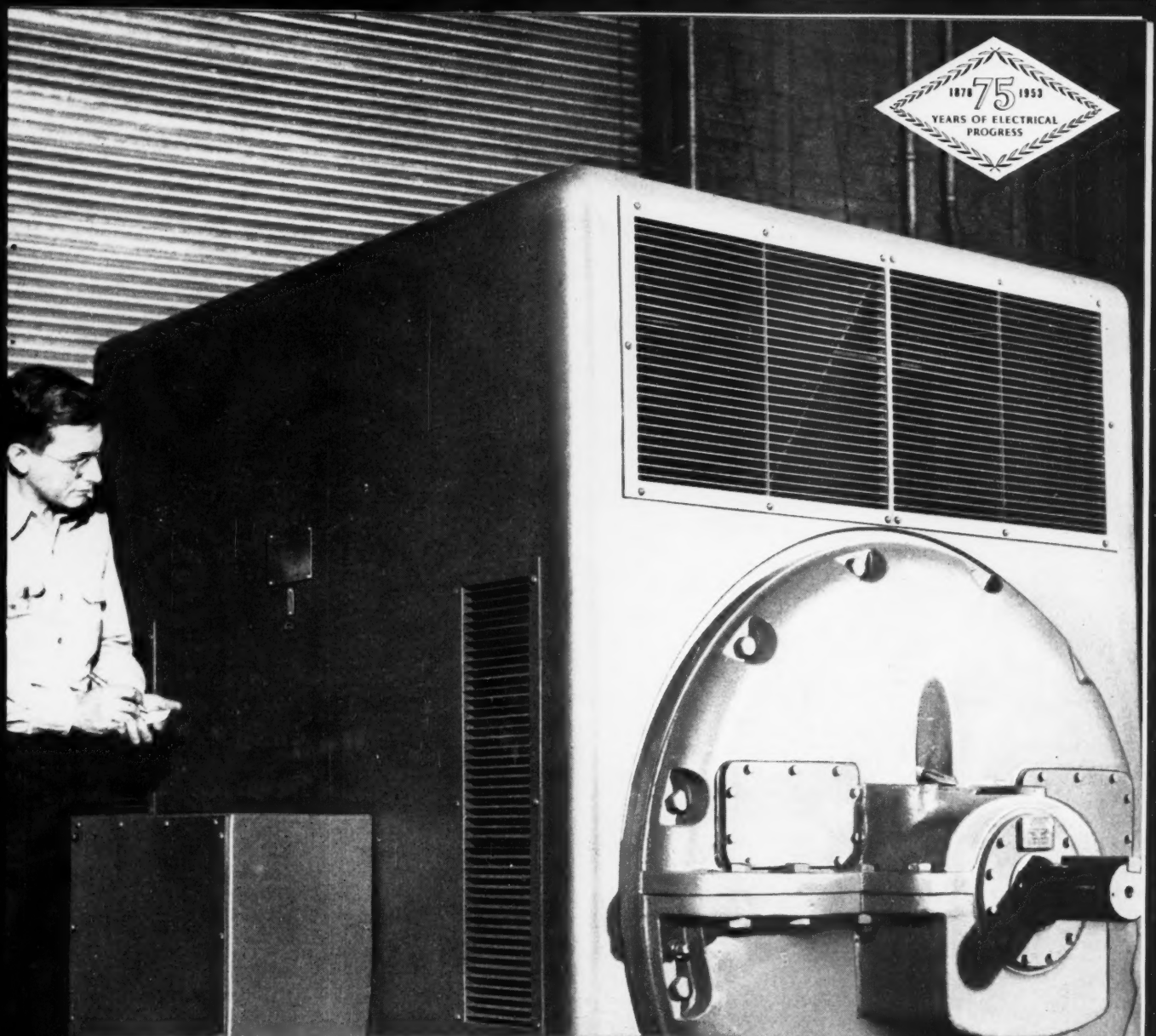
Although the initial cost of aluminum bodies is about 35% greater than steel bodies, savings resulting from the use of aluminum far exceeds the increased cost, according to F. O. Lewis, head of the company's transportation department. "Contrary to popular opinion, DP&L has found that aluminum bodies are just as durable as steel bodies," Lewis said. "Our company is still using an 18 year-old aluminum construction body that is as sound as the day it was built."

Three-ton aluminum construction trucks are about 2,000-lb lighter than the three-ton steel trucks. For this reason a lighter chassis and a smaller motor are used in aluminum body trucks. Life of the clutch, brakes and tires have also been increased because of the reduction in weight.

ALUMINUM BODIES on 65% of the truck fleet have cut fleet costs, eliminated corrosion, and no paint is required on the inside. Lighter weight bodies permit use of smaller motors

As a result of lighter weight, license costs have been reduced considerably. In 1951, the Company spent $87.00 per three-ton truck with aluminum body for license fees. License costs for three-ton steel-bodied trucks were $144.00 per unit in 1951.

Fuel costs, the largest item of expense, have decreased appreciably with the use of aluminum body trucks. In 1951, the company's aluminum bodied trucks averaged 5.6 mi per gal at a total cost of 17 cents per mile. The steel-bodied trucks averaged 4.5 mi per gal at a total cost of 20 cents per mi during the same year.



New G-E Boiler-feed-pump Motor

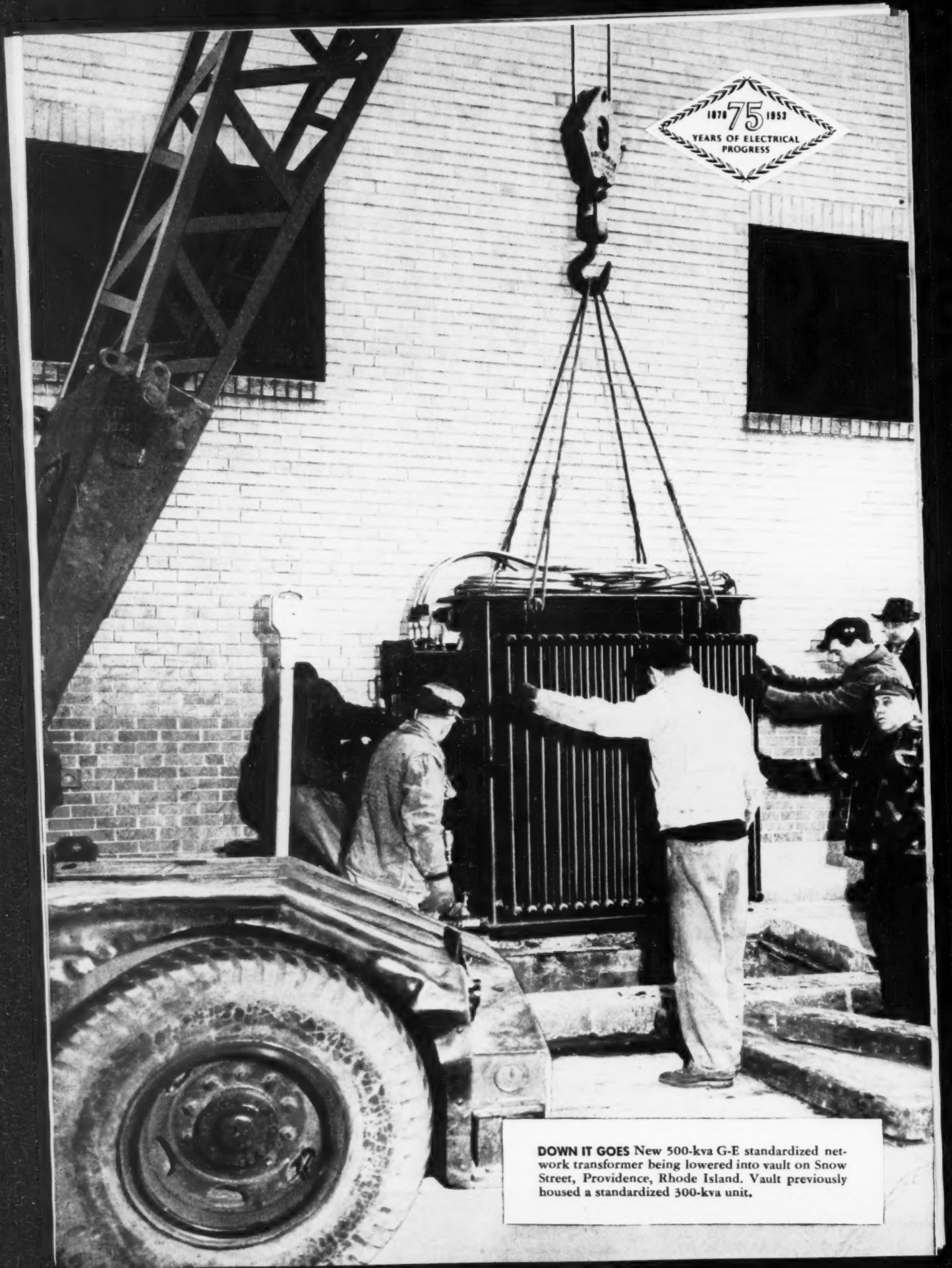
A true power station motor from top to bottom, General Electric's new Boiler-feed-pump Motor offers you many features—among them:

- **Cubical shape reduces width.**
- **Air discharge out top permits mounting motors closer together, improves employee comfort.**
- **Streamlined rotor improves performance—is quieter.**
- **Modern appearance blends with power station styling.**

For more complete information, ask your G-E representative for Bulletin GEA-5813, or write Section 753-1, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC



DOWN IT GOES New 500-kva G-E standardized network transformer being lowered into vault on Snow Street, Providence, Rhode Island. Vault previously housed a standardized 300-kva unit.

Load growth in Providence easily met by network system

New 500-kva G-E network transformer nearly doubles the capacity at this location as it replaces a 300-kva unit . . . using the same vault and cable connections.

In city after city secondary networks continue to demonstrate their flexibility and economy for meeting today's load growth—on an orderly, step-by-step basis—without any rearrangement of secondaries or service entrances.

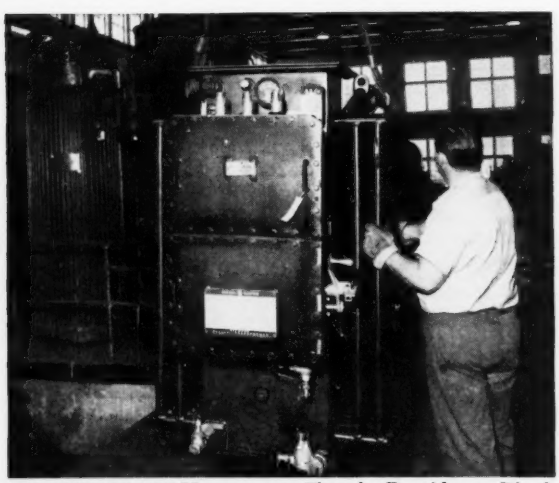
Providence, Rhode Island, provides a recent example. Load in the business district around Snow Street was climbing, due to increasing use of air conditioning, higher levels of illumination and general business expansion. Narragansett Electric, the utility, foresaw the need for additional capacity and simply ordered a new 500-kva General Electric standardized network transformer.

TRANSFORMER EASILY INSTALLED When the new unit arrived, it was placed in storage until actually needed. Then, utility crewmen removed the existing 300-kva unit and lowered the new 500-kva unit into the vault. It was tapped in on the secondary grid without interrupting service.

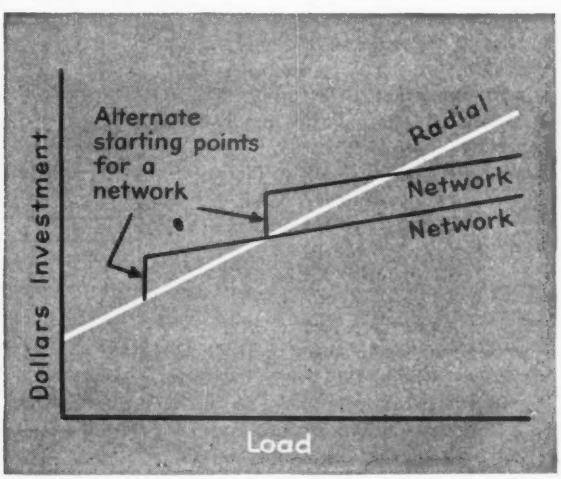
And that's all there was to it! Since both units were standard, no trouble was encountered in replacing the 300-kva unit with a 500-kva unit—the same vault and even the same cable connections were used!

HELP FOR YOUR SYSTEM If you're struggling to accommodate new loads by perpetuating a radial system and your load density has risen to approximately 10,000 to 15,000 kva per square mile, it may be time for you to investigate the flexibility and economy of a secondary network.

For help in solving your network problems and for complete information on the advantages of G-E standardized network units, see your local G-E Apparatus sales representative. Or write for Bulletin GEA-5024, General Electric Company, Schenectady 5, New York. 402-127



HELD IN STORAGE Narragansett Electric, Providence, Rhode Island, foresaw need for additional capacity and ordered new 500-kva unit which was held in storage until needed. With the new unit on hand, utility crewmen were able to schedule its installation well in advance.



IT PAYS TO START A NETWORK. Although the change from a radial to a network system means some initial expense, future increases in capacity require less investment with a network. And with a growing load, the sooner the network is started, the lower the ultimate cost.

GENERAL ELECTRIC

Parallel Operation of Transformers

Connections and requirements for parallel operation of three-phase banks are presented

J. B. HODTUM, Manager, Central Station Engineering
Allis Chalmers Mfg. Co., Pittsburgh, Pa.

Vector relations for parallel operation of three-phase banks are shown in the diagrams.

Diagram (a) represents the delta-delta connection of zero degrees displacement. Diagram (ar) represents the reverse side. Diagrams (b) and (br) are similar arrangements with 180-deg displacement, which is a non-standard connection.

Diagram (c) represents a 30-deg displacement for a delta-star connected bank. Diagram (cr) is the reverse-side view of the same connection. Diagram (d) is a non-standard connection of a delta-star connected bank where the (dr) diagram is its reverse-side view.

A convenient method for using this scheme is to draw the connections on the face of a card and the (-r) connections as viewed from the back. Connection (c) can be made to parallel with connection (d) by using the (dr) connection. This indicates that by connecting

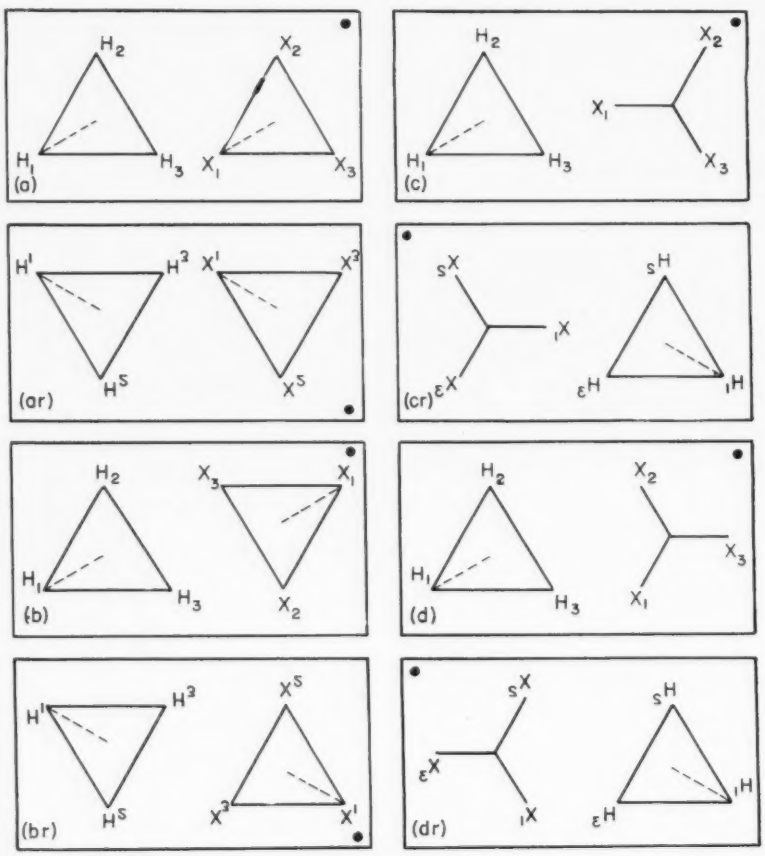
H1 of (c) to H3 of (d)
H2 of (c) to H2 of (d)
H3 of (c) to H1 of (d)
and
X1 of (c) to X3 of (d)
X2 of (c) to X2 of (d)
X3 of (c) to X1 of (d)

without making changes in the connections within the bank, the two units will parallel.

Note that (c) and (cr) are as front and back of the same card and (d) and (dr) are as front and back of the same card.

On the other hand, if bank (a) is to be parallel with bank (b), shuffling of the same card, will not indicate a proper connection and it is therefore necessary to reconnect one of the banks within the delta in order to produce the proper displacement for parallel operation.

System of Matching Vector Relations for Parallel Connections



For parallel operation, in addition to the proper voltage and phase displacement, it is necessary that consideration be given to the resistance and the reactance of each bank involved in the parallel operation. If the banks are to divide both kw and kvar loads, the percent resistance and the percent reactance of each bank should be similar. If they are paralleled on an impedance basis only, without regard to the resistance and reactance, they will divide kva but will not divide the kilowatt load.

Transformer excitation requirements and ampere-turn balance were presented in Engineering Reference Sheets No. 53-2 and 53-3, respectively in Electrical World, Jan. 26 and Feb. 9.

FOR CONDENSER AND HEAT EXCHANGER TUBES AND PLATES SPECIFY

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CUPRO-NICKEL—30%, 10%
ADMIRALTY METAL
ARSENICAL COPPER
ALUMINUM BRONZE—5%
MUNTZ METAL
REVALON (ALUMINUM BRASS)

• Correct selection is essential if tubes and plates are to serve with the maximum economy and minimum trouble. The Revere Technical Advisory Service and Revere Research Department are always ready to collaborate with equipment manufacturers and operators in specification matters. • When it is time to re-tube, remember that conditions may have changed since the original installation, and that it may be wise to re-check before ordering new tubes. • To take advantage of Revere's knowledge of copper and copper alloy tubes for all industrial purposes, get in touch with the nearest Sales Office. See your telephone book or write direct. Send for helpful booklet, "Life Extension for Condenser Tubes." Free.

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Service . . . *where and when you want it*

PROMPT, experienced service is one of the most important plus values you get when you buy Honeywell instruments. An unequalled organization of trained specialists is always at your call at more than 110 offices in the United States and Canada. Offices are located in practically every large industrial city of the country . . . close to every major production center.

Trained Personnel

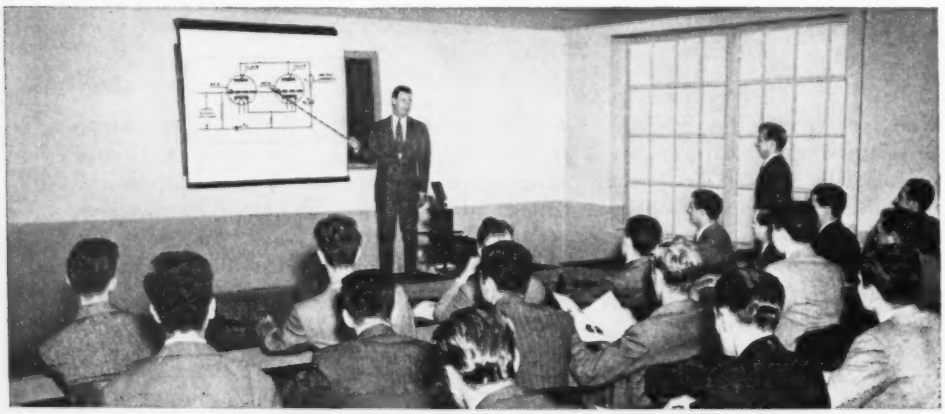
Honeywell service men are schooled not only in the theory of measurement and control, but also in the practical art of keeping good instruments in the best condition. Hand picked men begin this instrument education in an intensive training program in Honeywell factories. After graduation, they serve an apprenticeship in the field offices . . . while they learn still more about instrument maintenance from first-hand contact with plant problems. By the time a Honeywell man arrives at your plant on a call, he's a finished product worthy of the responsibility he bears, and capable of doing the kind of service job that you need . . . and that your Honeywell instruments deserve.

When trouble strikes, a wire or telephone call will bring a service man to your plant . . . often within a few hours. This assurance of prompt action means a lot to your production schedules. You'll never be left out on a limb because of delays in instrument maintenance.

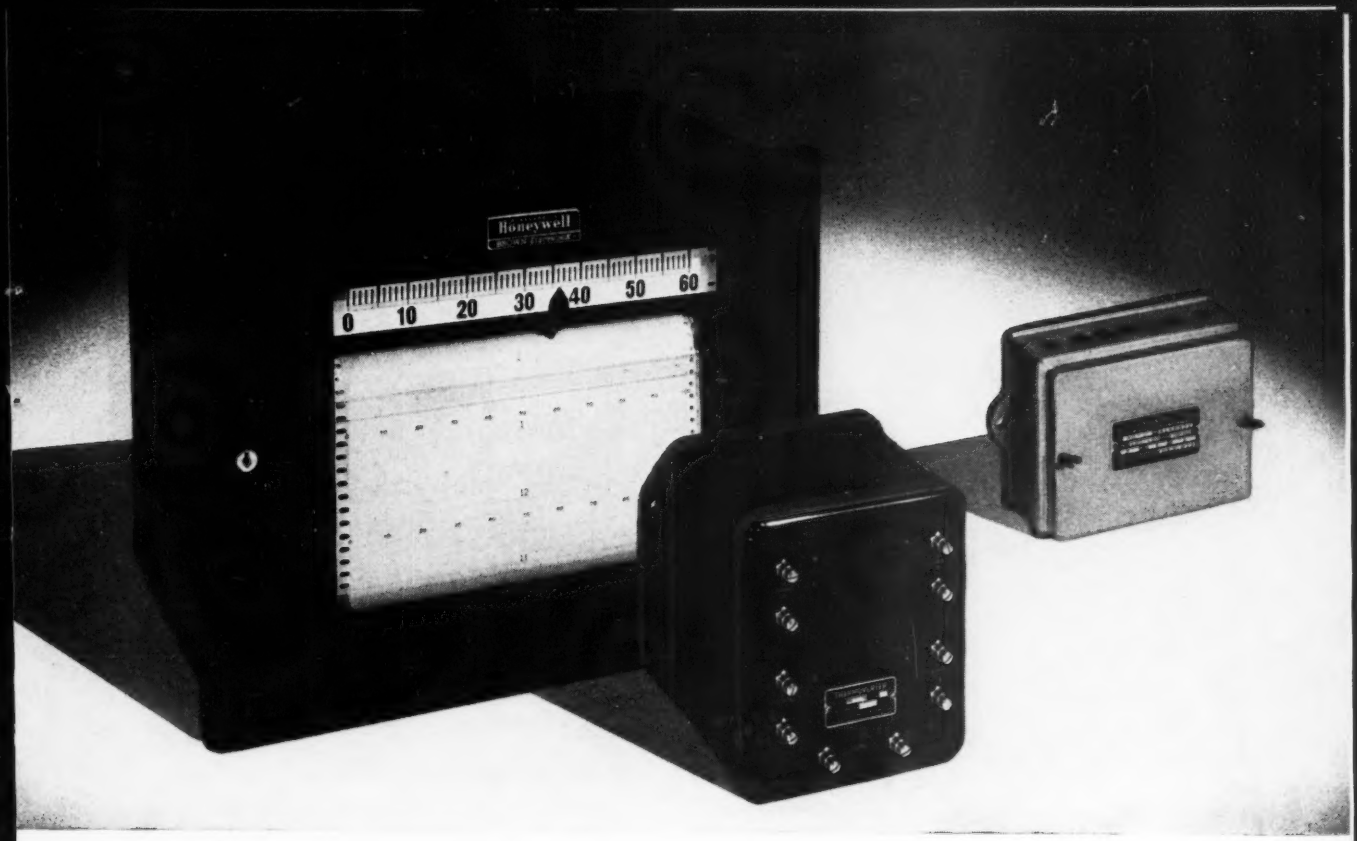
Periodic Service Plan

But why wait for emergencies? Preventive medicine works on instruments, too. And the prescription is simple . . . a Periodic Service Contract, which brings a Honeywell service man to your plant at regular intervals to inspect, clean and adjust any Honeywell instruments you have. The plan is economical . . . can save you many hours of lost production time. Your nearest Honeywell office will be glad to give you full details.

For accurate *depend on*



TRAINED TO SERVE: *In Honeywell's service school, students get a thorough grounding in instrument theory and practice. After graduation, they become part of the most extensive organization of its kind in the world . . . ready to serve you competently and promptly, whenever and wherever you need them.*



facts on electrical loads—
ElectroniK recorders

FOR RECORDING generator output, station generation, tie line interchange or system totals, *ElectroniK* recorders meet every specification:

They're accurate: "Continuous Balance" system measures *every* load change with peak precision, by means of all-electronic, non-cyclic balancing.

They're fast: keep pace with the most rapid load variations.

They're extra-readable: 11-inch wide chart and scale spread load data out in full, legible detail.

They're versatile: supplied in any desired kilowatt or megawatt range; operate with a thermal converter connected to standard instrument transformers. Adding a phasing transformer adapts them to measurement of reactive power.

They're dependable: like the thousands of *ElectroniK* instruments used throughout industry for temperature, pH, flow, and scores of other measurements, *ElectroniK* power recorders have exceptionally few moving parts . . . no delicate mechanical linkages . . . utilize rugged, life-tested components.

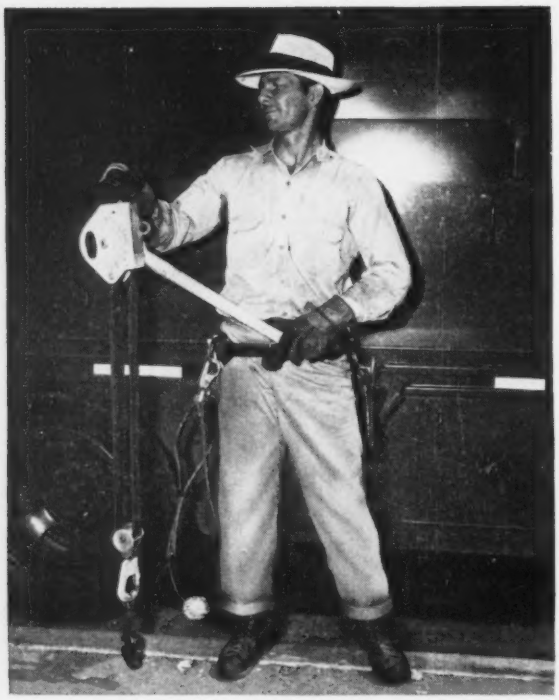
Your local Honeywell engineering representative will be glad to discuss your power-measuring problem. Call him today—he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Data Sheet No. 9.1-3 . . . and for Catalog 90-2, "Supervisory Instruments for Power Generation."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

H HONEYWELL



HOT LINE HOIST, displayed by author, is safe, practical and may be used with hot sticks for sagging, raising, or lowering conductors

LINE TENSION is adjusted to proper value with hot line hoist as hot line is deadened. Mechanical advantage of hoist is about 23:1

New Hoist Handles Energized Lines

JACK REYNOLDS, Lineman, Southern California Edison Co, Alhambra, Calif.

One lineman can sag and raise or lower energized lines with a safe and practical hot-line hoist invented by the author. Similar to a Coffing hoist in construction, the new tool can be handled by the lineman alone and does not require groundmen for pulling with blocks and tackle.

Hoist is rated at 1,500 lb with a 4 to 1 safety factor at 6,000-lb lift. A built-in shear pin is designed to shear at 1,600 lb to prevent overloading. Web belting used in place of the chain in a Coffing hoist is made of waterproof parachute rigging with a 9,700-lb rating.

Frame of the hoist is cast from magnesium aluminum alloy and is insulated from the hook by the web belt. A 15-in. wood handle develops rated lift with only a 70-lb pull. Rings are placed at strategic points on the hoist to allow handling with hot sticks.

Although the original model has been used for some time in one district by several heavy line crews, it is not in general use throughout the company's system because each line truck carries rope blocks which are used for purposes other than handling energized lines. Furthermore, the hoist does not replace the present heavy duty hoist rated at 1½-tons lifting capacity.

New hoist has been patented by the author and is currently being made by Pomona Pump Sales Co. Pomona, Calif.

Tie Wire Machine Increases Production

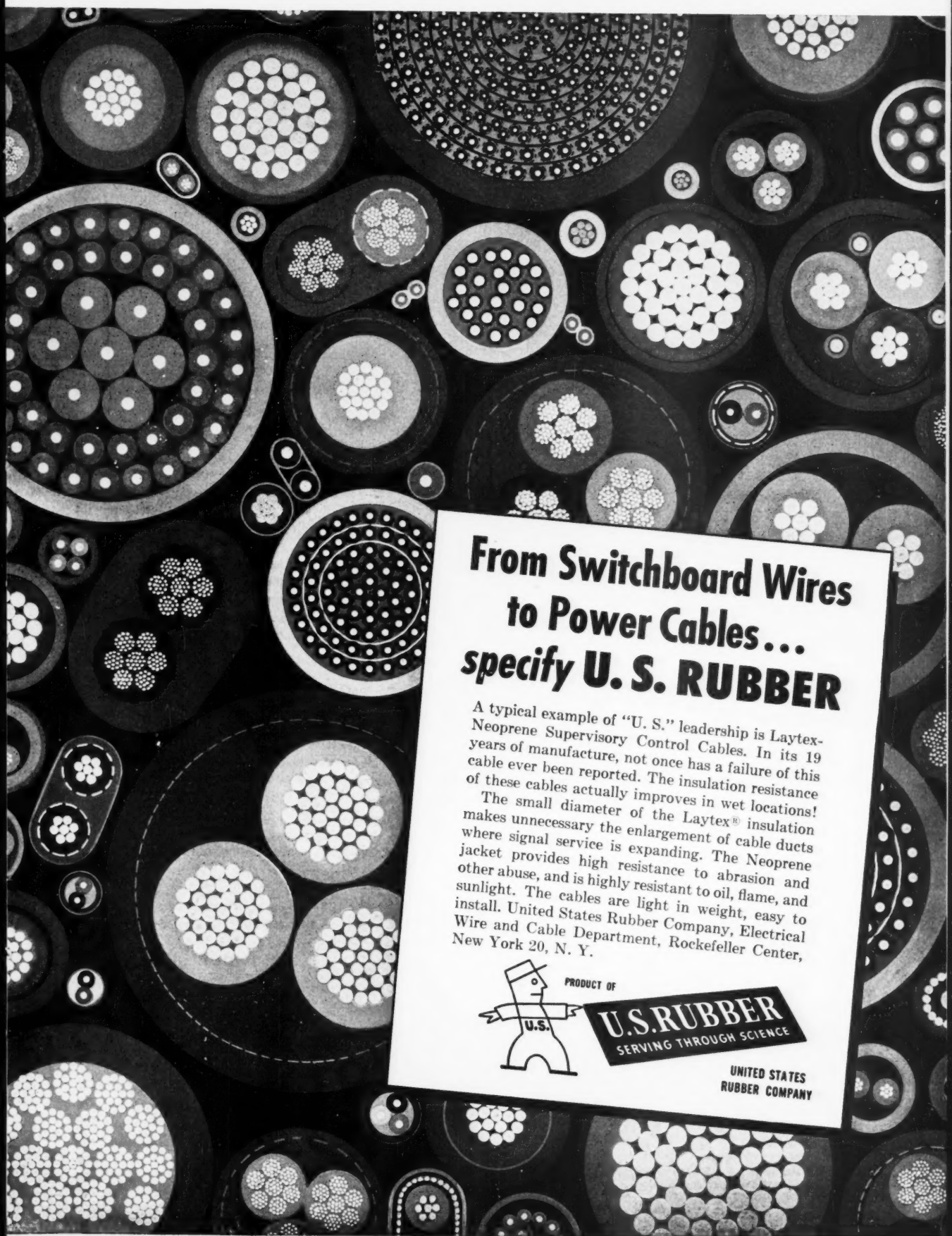
W. B. SULLIVAN, General Foreman, Shops & Special Services Division, Potomac Electric Power Co, Washington, D. C.

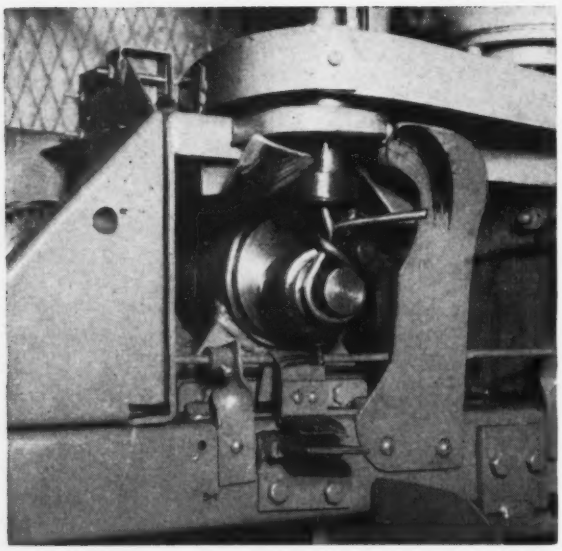
This hot line tie wire machine produces 10 times as many wires per day as was possible with the former hand method. It is fully automatic and produces a much more uniform product at the rate of six per minute. Two groups of 25 are placed with eyes on opposite ends to make a bundle of 50 for stock.

Designed by the writer after unsuccessfully attempting to purchase one from industry, the machine was assembled from discarded reduction gears, scrap angles, and sheet metal. The V-belts, pulleys, solenoids and precision switches are the only main items purchased for its construction.

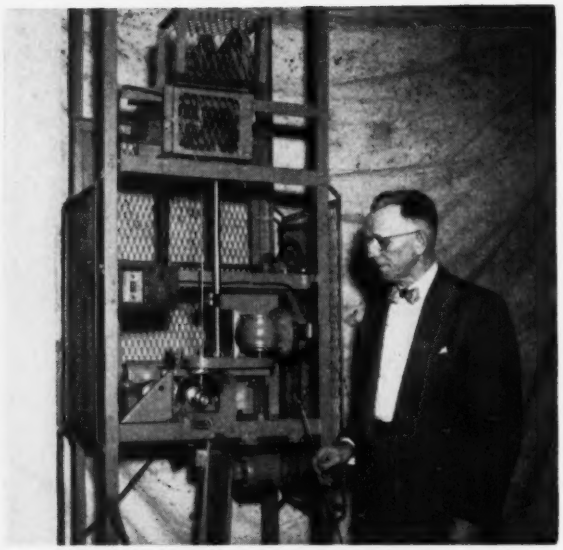
The drive is by V-belts from a shaft, which is driven by a ⅓-hp motor, to the three operating components, feed roll, eye former, and wrapper. Clutching is accomplished by positioning the driven pulleys so that the belt floats free of the driving pulley except when forced into contact with it by a small solenoid connected to a roller riding the belt near the driving pulley. The solenoids are actuated by precision switches under the control of a trigger and cams.

The wire is fed to the top of the machine through a shear and into the forming head between a mandrel and a finger. The end of the wire, after having passed through the form-


From Switchboard Wires to Power Cables... specify U. S. RUBBER
A typical example of "U. S." leadership is Laytex-Neoprene Supervisory Control Cables. In its 19 years of manufacture, not once has a failure of this cable ever been reported. The insulation resistance of these cables actually improves in wet locations!
The small diameter of the Laytex® insulation makes unnecessary the enlargement of cable ducts where signal service is expanding. The Neoprene jacket provides high resistance to abrasion and other abuse, and is highly resistant to oil, flame, and sunlight. The cables are light in weight, easy to install. United States Rubber Company, Electrical Wire and Cable Department, Rockefeller Center, New York 20, N. Y.
U.S.
PRODUCT OF
U.S.RUBBER
SERVING THROUGH SCIENCE
UNITED STATES RUBBER COMPANY



WRAP being applied after tie wire eye is formed on automatic machine which turns out six wires per minute



THE WIRE MACHINE produces 10 times as many wires per day as former hand method. Wires are more uniform

ing head, actuates a trigger which stops the feed roll and starts the eye former. The finger of the eye former then rotates through approximately 270 deg and, the mandrel being carried in an eccentric sleeve, moves over to center the eye. At this point in the operation, a wrapping finger picks up the projecting end of the wire and wraps it two times around the stem. While the wrap is applied, the shear is actuated to sever the tie from the wire.

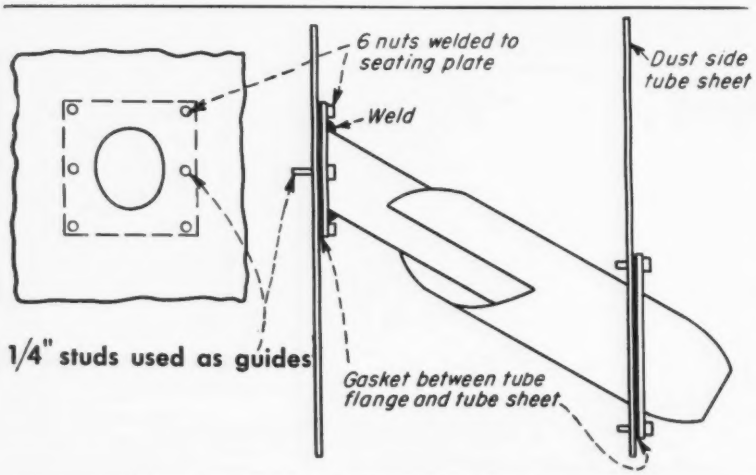
When the wrapping and shearing operations have been completed the mandrel is retracted which permits the completed tie to drop into one side of a two-compartment receptacle. The eye former then completes the cycle to a position to receive the end of the wire from the reel at which point the feed roll is started and the entire operation is repeated.

The receptacle is hinged at the center, and, after 25 ties have been deposited, a notched disk which is advanced one tooth per tie, by a 25-tooth gear, permits the weight of the ties to tilt the receptacle so that the other compartment moves into position to receive another group.

Dust-Collector Tube Replacement Made Easy

JAMES J. BRONCHIK, Tidd Plant, The Ohio Power Co, Brilliant, Ohio

Two ¼-in. studs have saved considerable time and eliminated trouble in changing dust-collector tubes. Using the method illustrated, two men (one on dust side, one on clean-gas side) were able to install 10 to 15 tubes per hour with minimum fumbling while trying to hold gaskets and line up cap-screw holes on the clean-gas side. Using the new procedure described here, an estimated 200 man-hours was saved in installing 1,678 tubes compared with the conventional method.


6 nuts welded to seating plate
Weld
Dust side tube sheet
1/4" studs used as guides
Gasket between tube flange and tube sheet

GUIDE STUDS screwed into nuts spot welded to the back of seating plate expedite positioning of dust-collector tubes on the clean-gas side of the dust-collector tube sheet

New tubes are attached to the tube sheets by 12 bolts—six at the large or dust end and six at the small or clean-gas end. Tubes received from the manufacturer have six nuts spot-welded to the back of the holding plate on the clean-gas outlet of the tubes. Before inserting each tube through the dust outlet in the tube sheet, two ¼-in. studs were inserted in diametrically opposite holes in the holding plate and screwed one or two

(*Continued on page* 143)

A METAL WITH Guts!

What story does this piece of bent iron tell?

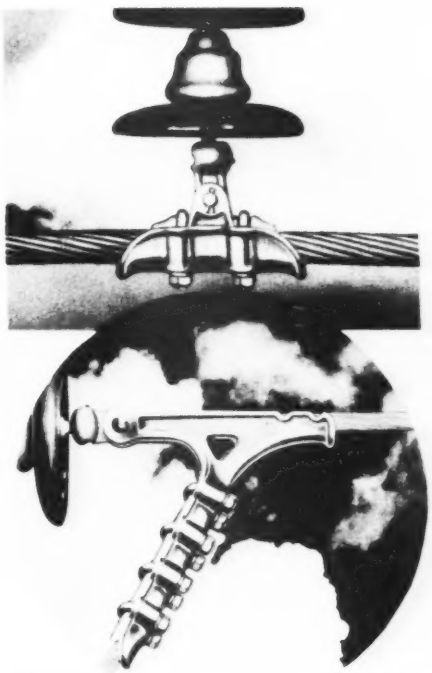
Every pot of castings that goes through the annealing ovens in the O-B malleable iron foundry contains one or more of these test bars (appearing above about natural size). When the pots are unpacked after treatment, the bars are bent by hammering to the shape shown here.

It may be hard to believe that a piece of CAST IRON could be so ductile, yet this is typical of O-B transmission line hardware. This is why O-B clamps can stand abuses far "above and beyond the call of duty" when the occasion arises.

Something the test bar doesn't show is malleable iron's great resistance to corrosion. Unlike steel and most other ferrous metals that go through continuous cycles of rusting and flaking away -- leading ultimately to serious weakness -- malleable iron tenaceously retains its original oxide coating, thus forming a natural protective layer that science has yet to equal for downright durability.

To be sure that the malleable iron used in its transmission line hardware is uniformly fine, O-B produces this material in its own foundries where every step of the process is under full control.

With full control to guard consistent quality, O-B malleable iron exhibits a surprising combination of strength and durability which it imparts to transmission hardware. You can put complete faith in "this metal with guts!"



Ohio Brass

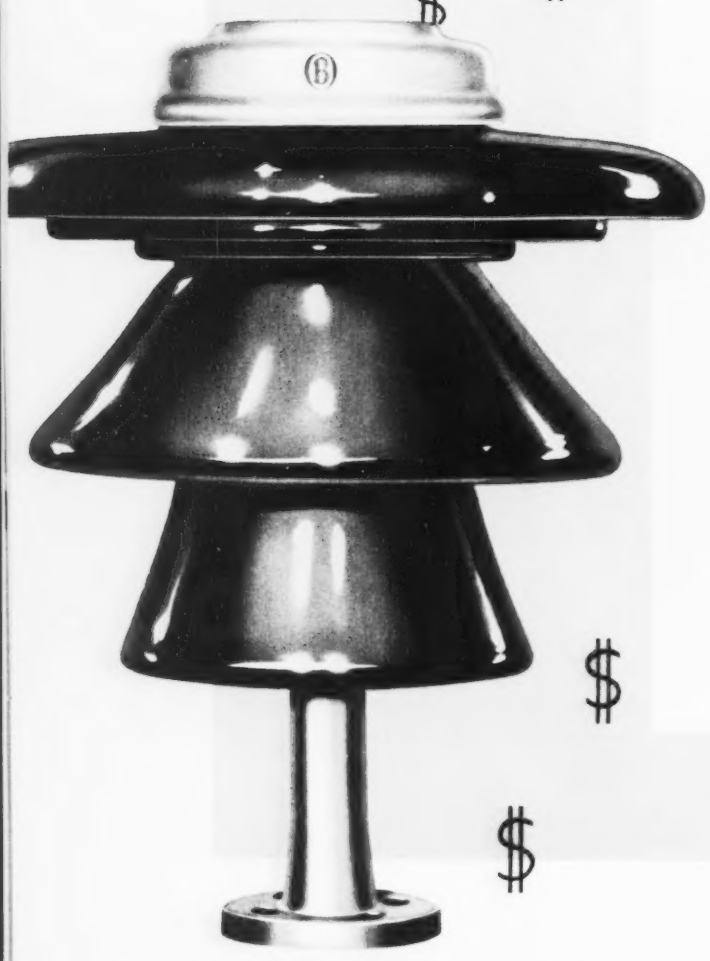
MANSFIELD, OHIO, U.S.A.

B

HI-TENSION NEWS *Junior*

When You Figure Years Per Dollar

. . . here's a real bargain!

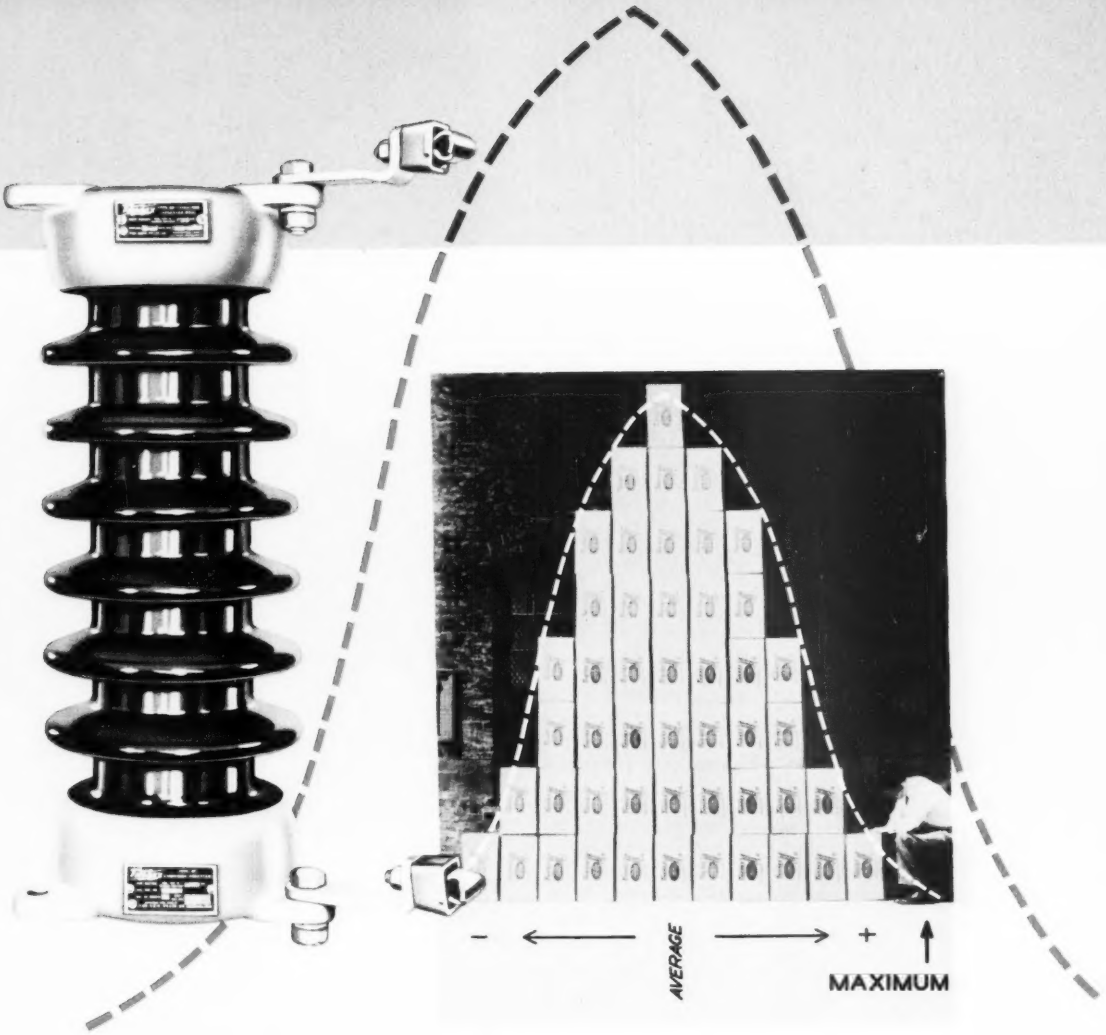


● If you ask, "Will this station insulator fit my system standards?", the answer is easily found, as the industry closely defines measurable factors.

If, however, you were to ask, "How long will this station insulator give satisfactory service?", there is no simple answer - - at least not until those years have passed.

Be sure to distinguish between what *can* and what *can't* be measured when you buy station insulators. Likewise be sure to recognize that *time* actually determines your real money's worth. And, years of performance can't be covered in a specification.

Most O-B station insulators are bought on repeat order, today, by men who have *had* their chance to gauge their money's worth. For a genuine bargain, figured in years per dollar, equip your stations with O-B.



MAXIMUM VALUES

. . . . An Arrester Rating You Can Trust!

Assume a large group of lightning arresters that have passed factory inspection and are ready for shipment. Possibly one *just passed* - - that would be normal expectation - - and all the rest are better. But, you use these arresters one-at-a-time. Is the one you are looking at the poorest, the best, or the average of the group? It would be well to know this, especially if the spread of performance is wide, before trusting it to protect a valuable transformer.

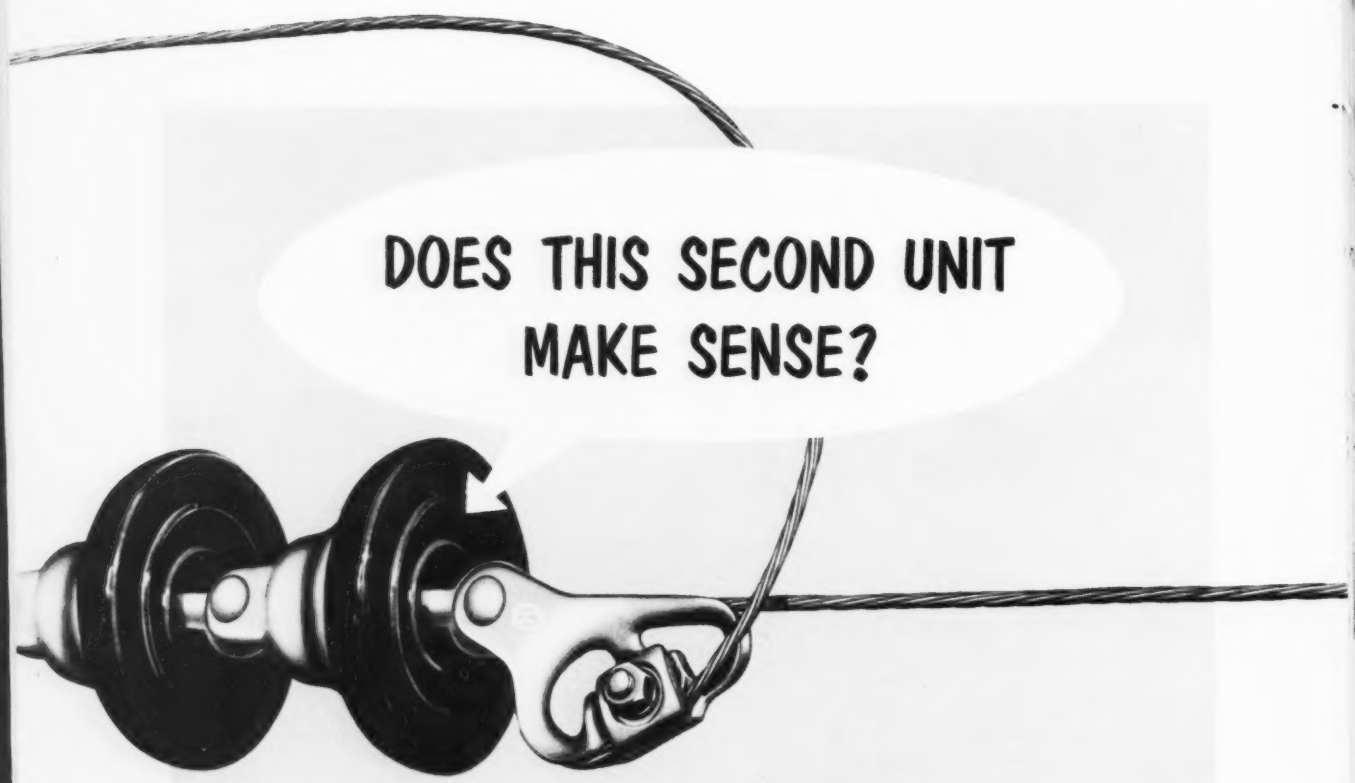
You have no answer to the question if your arrester is rated in terms of average performance. Average values don't imply that you will get an average specimen - - in fact they admit considerable departure from what you *think* you may have.

When you buy an O-B Thorex arrester, however, its rating is realistic - - in fact it is pessimistic! We rate *just one* unit. This is the poorest that will pass inspection. O-B arrester ratings state MAXIMUM values, not average. Every single Thorex arrester is as good or better than listed. Obviously, practically all are better. And even the MAXIMUM Thorex arrester is the biggest dollar's worth of protection that you can get.

When you put a lightning arrester to work, *know* what it will do. This means buying an O-B Thorex - - the only arrester sold under MAXIMUM ratings.

Ohio Brass

MANSFIELD, OHIO, U.S.A.



DOES THIS SECOND UNIT MAKE SENSE?

Let's say you build a primary distribution deadend at 4,000 volts, figuring at least 15 years' life, and using a single 6-inch suspension unit. Urban residential power consumption has increased 3½ times in only 13 years, and the rate of increase is quickening. Will 4,000 volts do the job, not in fifteen years, but perhaps five years? If voltage goes up, a second insulator unit must be added to the deadend. Is it wise to build that deadend twice when once would have finished the job?

What does it cost in time to rebuild this deadend, probably hot? What is involved in getting rid of an extra five inches of sag imposed by the second unit? Will these costs look good compared to a couple of extra dollars spent originally? That's all we're talking about.

In other words—at the time of original construction does this second insulator unit make sense?

Ohio Brass

MANSFIELD, OHIO, U.S.A.

4229-H

Dust Collector

(*Continued from page* 138)

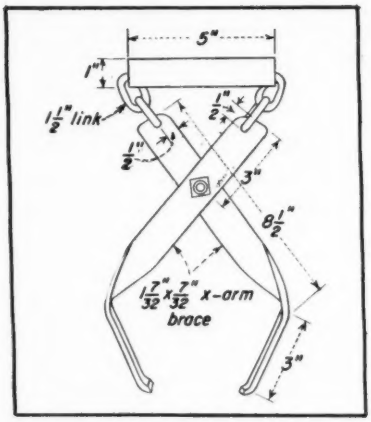
threads into the nuts. The studs supported the clean-gas exit gasket. As tubes are inserted through the dust-exit holes in the tube sheet, these two studs guide the tubes into position for attachment to tube sheet on the clean-gas side. The two studs are guided into place much easier than when bolts are in all six holes. While the tube is held by the two studs, four cap screws were inserted in the remaining holes from the clean gas side. Studs are then replaced with cap screws and all cap screws tightened.

Attachment of the dust end of the tubes is done in the conventional manner according to the procedure recommended by the manufacturer.

Tong-type Carrier Developed for Batteries

JAMES COOK, M. P. KIRK Jr, Substation Maintenance Dept, Appalachian Electric Power Co, Bluefield, West Virginia

A carrier in the form of tongs has been developed for handling the 6-volt type DD-3-3 storage batteries, which are used for oil circuit breaker tripping and for emergency standby power at



BATTERY CARRIER TONGS grip the two ends of batteries preventing damage to terminal posts, caused by another type carrier

utility radio stations. The tongs grip the case under the end ledges and cannot slip when the battery is lifted quickly.

This battery carrier is made from two pieces of crossarm braces that serve as the tongs, one bolt, four chain links, and a handle-length piece of pipe. Dimensions and assembly of

NEW

Tri-onic*

*Interrupting Capacity 25000 Amperes A. C.

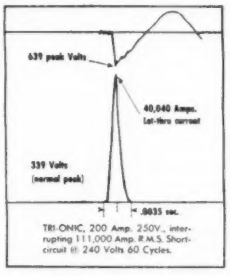
Interrupting Capacity Rating in excess of Underwriters' Laboratories Standards is established by tests conducted in accordance with AIEE Standards #25 on Power Fuses and NEMA Standards on Power Fuses.

SHAWMUT'S NEW TRI-ELEMENT

All-Purpose Superfuse

Here is a newly designed All-Purpose Superfuse. Use it wherever you need One-Times, Renewables or Dual Element fuses. Tri-onic is the first low voltage fuse with a published interrupting capacity of 25,000 Amps. at rated voltage for fuses. This is 15,000 Amps. more than required by Underwriters' Laboratories Standards for fuses.

TRI-ONIC, THE NEW TRI-ELEMENT SHAWMUT SUPERFUSE COMBINES:


639 peak Volts
40,040 Amps. let-thru current
339 Volts (normal peak)
.0035 sec.
TRI-ONIC, 200 Amp. 250V., interrupting 111,000 Amp. R.M.S. Short-circuit @ 240 Volts 60 Cycles.

A TRI-ONIC FOR EVERY CIRCUIT
These new high I.C. protective devices are available in 141 normal current ratings, ranging from 1/10 to 600 Amps. for both 250 and 600 Volt circuits. For safety's sake insist on Tri-onic. Protect yourself and your circuits. Send for Tri-onic Bulletin now.

1. ***HIGHER I. C.*** 25,000 Amps. @ 250V and 600V. It can handle short-circuits 2½ times larger than ordinary fuses. Tri-onic expands fuse application into the 25,000 Amp. zone with the same interrupting rating and time-current characteristics as 25,000 Amp. molded case air circuit breakers. Buy Tri-onic for bus plug-in duct, bus-ways, feeders, motor control panels and branch circuits.

2. ***LONG TIME DELAY,*** based on heat absorption principle, permits Tri-onic to safely start heavily loaded motors without blowing. Eliminates needless "outage" of circuits due to heavy inrush currents or load swings.

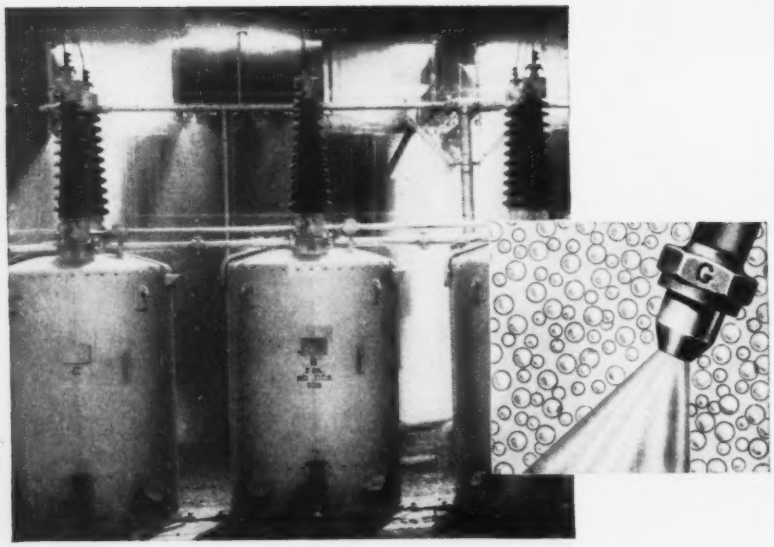
3. ***COOLER*** due to Tri-onic's inherent low resistance. I^2R losses very low. Blowing temperature is 286°F or 500 degrees lower than that of ordinary zinc links. Use it for distribution boards, panel boards, motor starting panels, knife and enclosed switches.

OUR 60 IN YEAR "FROM EDISON TO ELECTRONICS"

Tri-onic – "Awake At The Switch"

THE **CHASE-SHAWMUT** CO.

370 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS



OIL FIRES

From our files . . . facts about 3 typical oil fires which Grinnell Mulsifyre System quickly, safely

EXTINGUISHED

Complete extinguishment of fires within areas protected with Grinnell Mulsifyre sprays is usually obtained in a matter of a few seconds after the water discharge starts. Case histories prove that Mulsifyre projectors are effective wherever the danger of fire in medium or heavy oils can be limited to a definite area. In these oils the surface emulsion remains to give after-protection against flashback.

Avoid future trouble from fire. Check the facts below on the reliable way Grinnell emulsion-forming spray systems operate. Then communicate with Grinnell Company Inc., Providence, R. I. or with one of the branch offices located in principal cities.

The record speaks for itself . . .

1. This is a case of a bank of three 12,500 KVA single phase transformers, oil insulated and water cooled. An arc flashed below the oil surface from low voltage leads to the iron core. Relief diaphragm ruptured, forcing out oil whose vapors ignited. Automatically operated Mulsifyre System extinguished the fire before it could damage adjacent transformers.

2. Here's another instance...drizzle-wetted coal dust, streaking on an insulator, caused a flash-over which ignited an oil spill. Manual operation of a gate valve turned on the fixed Mulsifyre System, extinguishing the fire.

3. And another! Repeated operations of automatic circuit breakers due to severe electric storm caused oil spray and spillage which was ignited by flames coming from tanks through explosion vents. The explosion blew out three outside brick walls of switch room. The Mulsifyre fire protection system went into action and it extinguished the resultant fire.

GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

the parts are shown in the sketch.

Two points to be remembered when using this all-metal carrier are: (1) Careless handling of the tongs should be avoided to prevent short circuiting the terminals; and (2) relieving the weight held by the tongs will release their grip.

This carrier was developed because a commercial device was apparently unavailable. One obtainable form has two open straps (C-shaped) that grip the terminals of conventional batteries. It is not favorable for the type DD-3-3 batteries because there is danger of breaking the posts loose from the plates if the battery is lifted suddenly. Another method—some battery servicemen believe that the battery should be lifted from the bottom of the case, but if it tilts it may be dropped.

Use Binding Twine To Raise Conductors

Cost of building a 7.2-kv single-phase line through rolling, wooded terrain was held down to about $1,300 per mile by California Oregon Power Co, Medford, Ore., through use of common binding twine for raising wires and mechanical equipment for clearing right-of-way.

In building the six miles of No. 2 ACSR line, ground crew attached pole-top insulators and neutral brackets before poles were set. Lengths of twine were run through the insulator and bracket so that both ends would reach the ground when the pole was raised.

With a section of poles set, conductors were run out and raised to position by the ground crew with the twine. This eliminated the need and cost of having a lineman standing by and climbing poles while conductors were being raised. With conductors in the air, a lineman went down the line sagging and attaching conductors.

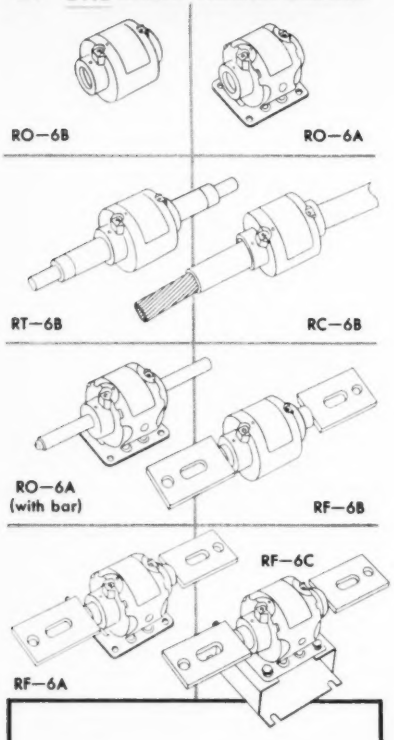
Clearing of trees and underbrush in the right-of-way with power chain saws also contributed to the decreased cost per mile of line.

Weed-Killer Cuts Cost and Grass

Fire-hazardous weeds and grass around Georgia Power Co's substations are removed with less expense

(*Continued on page* 148)

EIGHT VARIATIONS
OF ONE BASIC TRANSFORMER



SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Sangamo Type R

Current Transformers

600 Volt—25/60 Cycle

These completely new current transformers lend themselves to a great variety of installations that help lower the overall cost of measurement of low voltage loads.

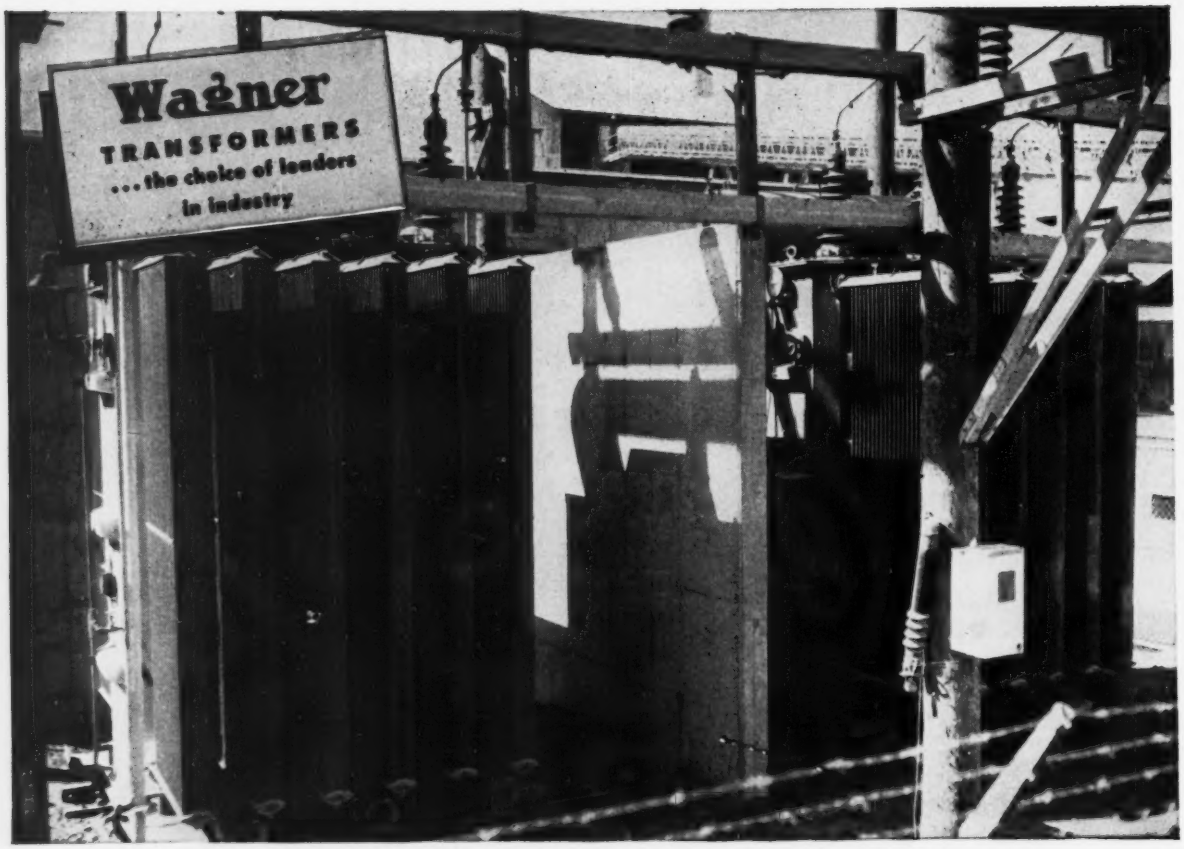
They are exceptionally small in size (the basic transformer is less than 4" in length)—but meet the A.S.A. 0.3 metering accuracy classification for B-0.1 and B-0.2 burdens. They are so light in weight that good practice will be met even if they are supported by the primary conductor only. They have ratings of 200 and 400 amperes and have a current carrying capacity of twice their nominal rating.

Type R Transformers are encased in a bakelite shell filled with a thermo-setting plastic that eliminates all voids and prevents moisture from reaching the core or windings even when submerged.

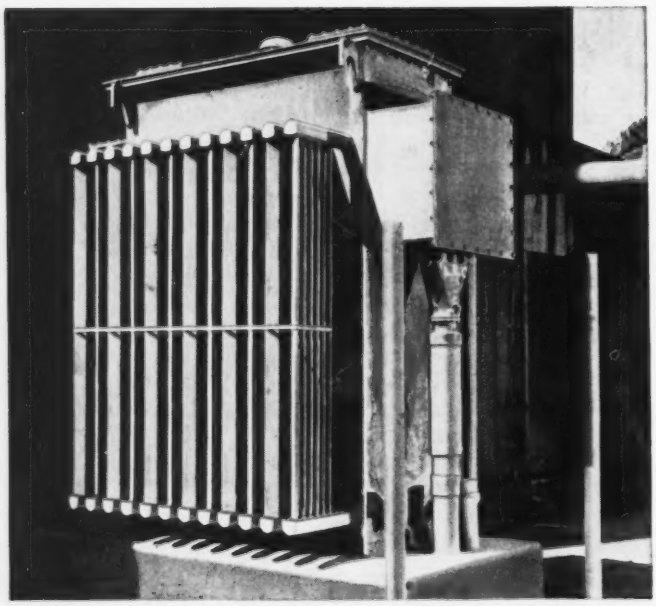
The eight variations, shown at left, permit a variety of primary arrangements to meet almost any form of connection. This new type of transformer permits the engineer to use his ingenuity in devising cost cutting methods of installation. Full information is given in Bulletin 501. Write for your copy today.

Only Measured Facts are Known Facts

SM53-2



DUPLICATE TRANSFORMERS and feeders allow either to carry load in emergencies. The three phase Wagner Power Transformers are each rated 6000 kva with provision for an increase in capacity to 8000 kva for future expansion.



ONE OF FIVE Wagner three phase, non-inflammable liquid filled unit substation transformers used in this installation. Each transformer is rated 750 kva, 2400 to 480 volts, 60 cycle; and each is located as close as possible to load center.

Wagner Power Transformers have been serving the power industry dependably for over sixty years. They are compact in design and are built with painstaking care to give them inherent strength and stability. They have sufficient capacity to not only carry their normal load, but to be able to handle loads—again and again—whenever emergencies arise.

Consult a Wagner engineer on your next transformer installation. Thirty-two branch offices, located in principal cities, are at your service. Bulletins TU-180 and TU-181 give information on the complete line of dependable Wagner Transformers.

Wagner Transformers selected for modernized distribution system in midwest cement plant

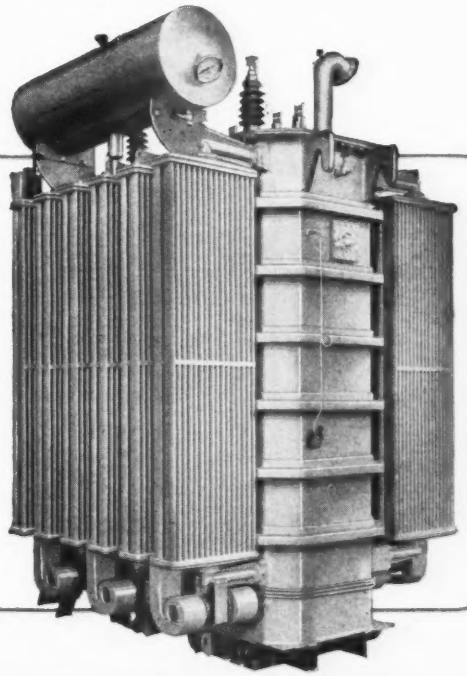
Cement making is a 24-hour, 7-day week business requiring some 80 separate operations, the use of much heavy processing machinery and equipment, and tremendous amounts of dependable power.

The modernized Prospect Hill plant of the Missouri Portland Cement Company provides a fine example of an up-to-date distribution system in an application where considerable amounts of power are utilized at primary voltages. 12,000 kva of transformer capacity was required for connected and demand loads, with provisions for a 33 percent increase in capacity for future expansion.

Two Wagner 3 phase power transformers, each rated 6000 kva, with an ultimate of 8000 kva to be obtained with the addition of cooling fans, were used to meet this requirement for the main substation.

In addition to the main substation, there are five 750 kva unit substations, each located as close as possible to the load centers of the particular areas they serve. These substations are powered by three phase Wagner unit substation transformers, each with identical specifications.

Wagner transformers were chosen for this installation, as they are for a great many industrial and power company installations, because of their ability to give continuous service over unusually long periods of time.



Wagner Power Transformers meet ASA C57 standards

Now, you can simplify your specifications and gain the advantages of improved design at reduced cost by ordering *standardized* Wagner Power Transformers. Wagner Transformers meet all ASA C57 standards for voltage ratings, taps, impedances and both standard and optional mechanical features. Get full information from your nearby Wagner engineer, or write us.

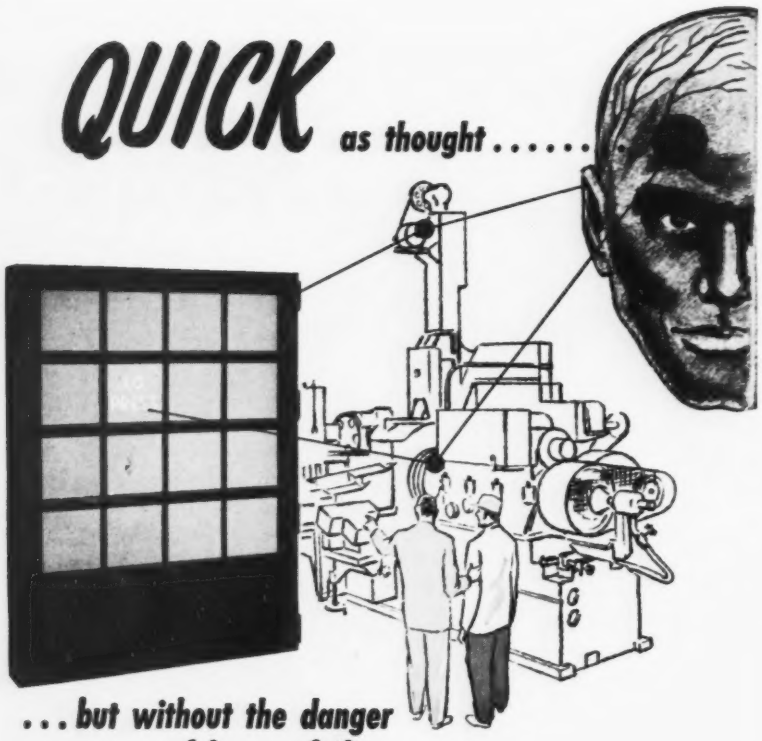
® Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Avenue • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T53-1



AUTH

SUPERVISORY ANNUNCIATORS
provide audible and visible signals that

- ***PROTECT YOUR EQUIPMENT***
- ***SPEED YOUR PROCESS***
- ***SAVE YOUR PRODUCT***

Dependable AUTH equipment prevents costly breakdown of vital services or expensive equipment by giving insistent visible and audible alarms of such conditions as overheated bearings, low fuel level, high cooling-water temperature, low or high pressure, end of a processing cycle, etc.

AUTH SUPERVISORY ANNUNCIATORS work this way:

when trouble occurs, a supervisory annunciator receives an electrical impulse from a normally open or normally closed, momentary or maintaining contactor, such as a thermostat, pressure or float switch. This impulse is converted in the annunciator circuit to a maintaining circuit that operates a visible signal indicating the source of trouble, and simultaneously sounds an audible alarm. Various operations sequences are available.

Write today for complete descriptive literature, without obligation!

SINCE 1892 AUTH

COMPLETE SYSTEMS • ONE RESPONSIBILITY

AUTH ELECTRIC COMPANY, INC.
34-20 45th St., Long Island City 1, N.Y.

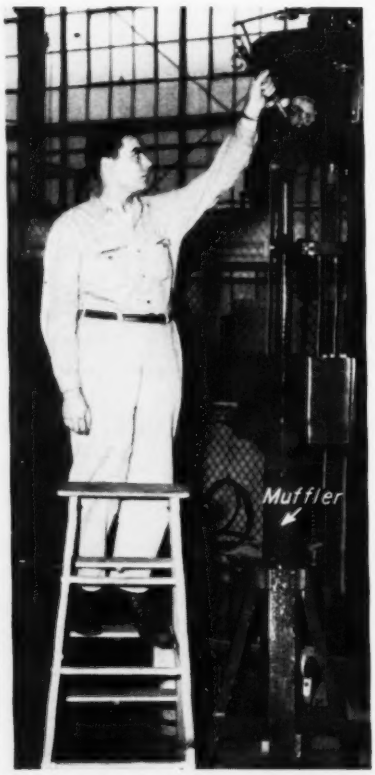
MANUFACTURERS OF: Electrical Signaling, Communication and Protective Equipment for Housing, Hospitals, Schools, Offices, Ships, and Industry.

by Dupont's CMU chemical herbicise, experiments show. The new CMU-3(P-Chlorophenyl)-1, 1-Dimethyurea-sterilizes soil and prevents plant growth.

The powdery chemical is readily suspended in water but slowly soluble, so that it does not leach out quickly in the rain. It acts on plant roots, is best applied when plants begin to grow.

Using CMU 80%, 40 lbs per acre gave best results. Nut, Johnson, and bermuda grass were most difficult, sometimes required second application. Mixture, 4 ounces to 2 gal water for 200 square feet, should be sprayed or sprinkled, keeping chemical agitated.

Application is effective about two years, and is not toxic or inflammable.



Car Muffler Quiets Expulsion Fuse

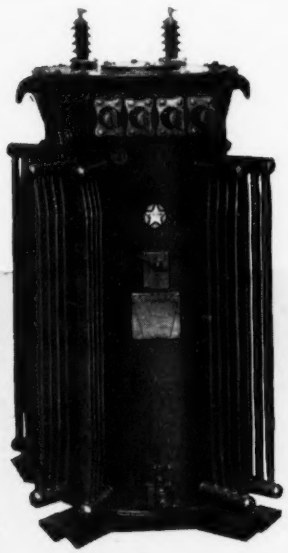
Objectionable noise caused by interrupting current with an expulsion fuse in Ohio Brass Co's laboratory has been reduced with a muffler. The muffler, for a Buick Roadmaster, was installed in an upright position below the expulsion fuse. Currents of magnitudes less than 5,000 amp can be interrupted now with a minimum of discomfort to employees.

4000 The Pole Star CORE makes the difference...

The patented design of the Pole Star core enables Pennsylvania to build Pole Star transformers through the full range of distribution sizes from 3 Kva through 500 Kva and from 2400 volts through 43800 volts. The Pole Star core takes full advantage of the high permeability and low loss characteristics of the oriented electrical steel and provides a core with low exciting current and low core loss.

Core Builder assembles laminations in 500 Kva Pole Star Coil

Laminations are brought through the coil and individually lapped. For ease of handling, core units for the 167 through 500 Kva sizes are constructed with four core sections. Each individual lamination forms its own magnetic path so that no flux has to cross from one turn to the next. In effect, each lamination is a core in itself.



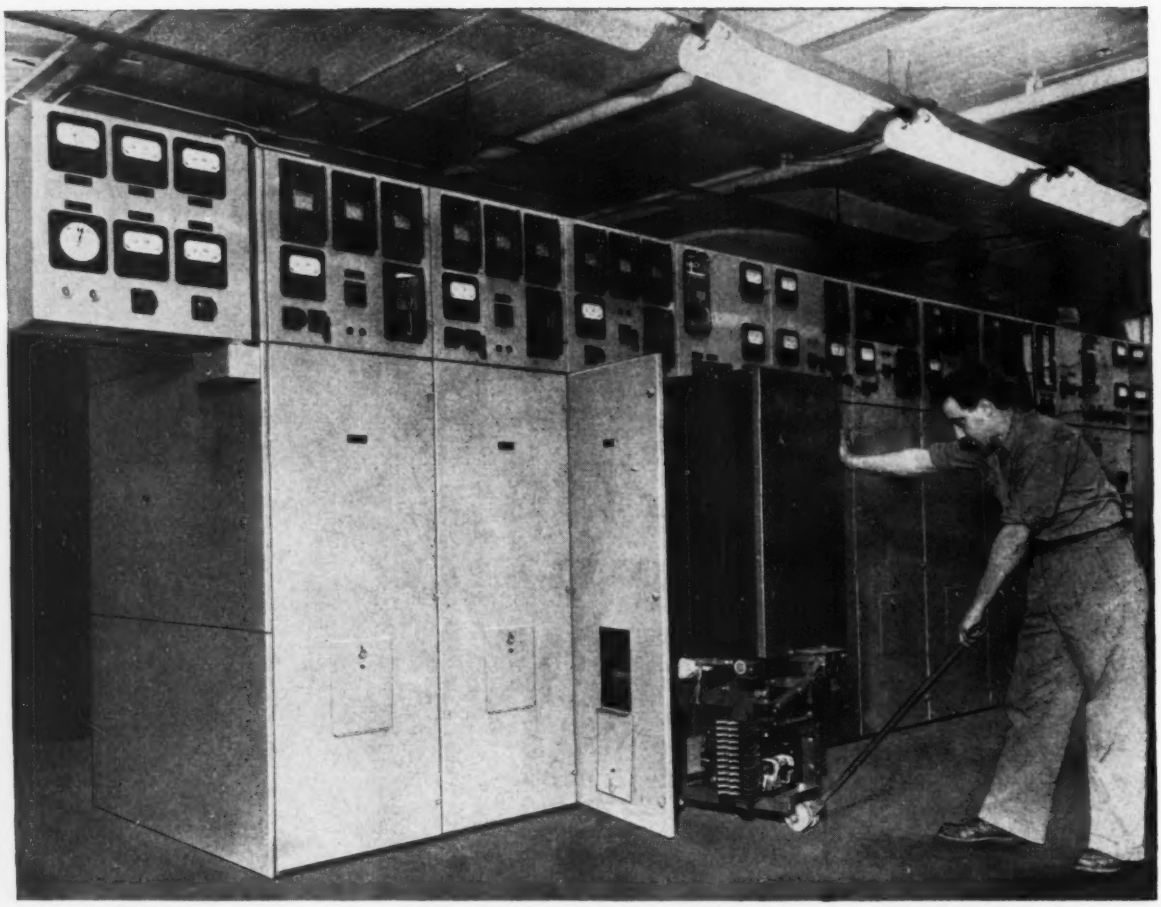
For complete information on 167 to 500 Kva Pole Star transformers, write for free copy of Catalog No. 352.

PENNSYLVANIA POLE STAR TRANSFORMER

Pennsylvania TRANSFORMER COMPANY

BOX 330, CANONSBURG • PENNSYLVANIA • *Greater Pittsburgh District*

I-T-E Horizontal Drawout Switchgear



I-T-E Metal-Clad Switchboards complement latest engineering advances with neat, modern design. HV circuit breakers are easily withdrawn from compartments. Safety is the keynote.

Indoor and outdoor equipment in ratings: 4160 volts—50,000, 150,000, and 250,000 KVA interrupting 600, 1200, and 2000 amperes continuous

20 years and more of easier handling

Modern switchboards last 20 years or longer. During this period, you can expect periodic inspections, load changes, certain maintenance, and, of course, short circuits and overloads.

Consider the outstanding advantages to yourself of I-T-E *horizontal drawout* switchgear over the life of the equipment in each of the following instances:

When inspections are made

Truck-mounted circuit breakers can be wheeled out of compartments quickly and easily. Safety shutters isolate "live" contacts in the compartment. Connected equipment can then be examined carefully without danger to personnel.

When loads change

Relay settings are quickly adjusted to compensate for load changes. On wider load variations, current transformers may be changed. Isolation of compartments in Metal-Clad construction permits these changes without interference with the main bus. Circuit breakers may be removed from their compartments to assure complete safety. Horizontal drawout circuit breakers in drawout switchboards make this possible and *convenient*.

When maintenance is performed

Each circuit breaker is withdrawn from switchboard, checked, and adjusted if necessary. Service continuity is assured. While the circuit breaker is out of service, a spare can be used to replace it. One spare circuit breaker provides adequate insurance for many feeder circuits.

Your local I-T-E sales engineer will be glad to show you the specific advantages of Horizontal Drawout Switchgear in your own application. Or for complete details on I-T-E Metal-Clad Switchgear, send for Bulletin 7004-B, Dept. ED, I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.

METAL-CLAD SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY
19TH AND HAMILTON STREETS • PHILADELPHIA 30, PA.
R&IE Equipment Division • Greensburg, Pa.

BRAILLE TIMER is used by Miss Floy May (at right) to demonstrate pressure cooker to Magalene McGutha, blind student. Familiarity with electrical appliances will encourage blind people to use them

REPAIR JOBS on electric cords being made by four totally blind students under direction of Miss May. Students did a neater job of repairing cords entirely by feel than do most sighted students

Blind Students Taught Appliance Use and Repair

EDITH HITCHCOCK, Home Service Director, Alabama Power Co, Birmingham, Ala.

Blind students, for the first time, are taught how to prepare meals on the electric range and how to use and care for other electric appliances at the Alabama State School for the Blind, at Talladega. This was accomplished by Floy May, Home Economist at Talladega for Alabama Power Co, who offered to present the 12 lesson course in the school's new Home Economics Laboratory.

This course has created much interest among blind students and the faculty of the School. The information they receive can be applied to their everyday life which will make their living more normal. It is felt that as a result of the course, more blind people will use electrical equipment in their homes because they realize that it is simple and safe for them to operate. The officials of the School were so pleased with the course that they asked Miss May to teach a similar course to all home economics students every year.

In order to get the fundamental principals of meal preparation across to her prospective students, Miss May practiced preparing meals while blindfolded. In this way she discovered obstacles that would have to be overcome before the young girls could do the work themselves. When classes began, the students helped even more by giving names to processes. They coined the names "Smellevision" and "Feelevision." They learned to listen for reduced sounds of escaping steam in order to determine when food was done; locating the center of a waffle iron by the feel of the heat area; to "smell" the progress of food being cooked.

Through their sense of touch, the girls learned to operate controls on the range, to clean it, place oven racks and load them with food to be cooked. Some controls on the range were notched—some were not. Miss May taught students to repair electric cords and she reported that they did better jobs than many people with full sight.

Through the use of mechanical potato peelers, tongs for turning and serving food, an automatic timer with Braille numerals, and patient practice, the girls were "graduated" to preparing complete oven meals, skillet meals, broiler meals, as well as special individual dishes. They were excited by their first success in development of the ability to fry an egg.

Fan-less Convection Heater Introduced

First convection electric heater that moves a significant volume of air without using a fan or blower is the claim of Federal Malleable Co, Milwaukee, Wis, for its new "Vectaire" unit. The heater is offered in two sizes—110 v, 1500 w portable for supplemental heating, and 220 v, 3,000 w, which will be available both as a portable and for permanent installation.

The heater utilizes the Venturi tube principle by which expansion of heated air through a constricted orifice creates a velocity that picks up about 40% more air. Output air is stated to carry 94% of the input engergy. In the 1500 w unit the volume of air averages about 45 C.F.M. Both units are 21 in. high and 11 in. wide. The smaller is 17 in. long and weighs 22 lb. The larger is 28 in. long and weighs 38 lb.

Freezers Only Appliance With Shipments Increase

Electric home and farm freezer was the only large appliance with a long marketing history to register a gain in factory shipments during the first ten months of last year, according to figures of the National Electrical Manufacturers Assn. Shipments for the span totalled 696,168 units, compared with 651,743 for the similar period in 1951. Ten-month figures on other appliances:

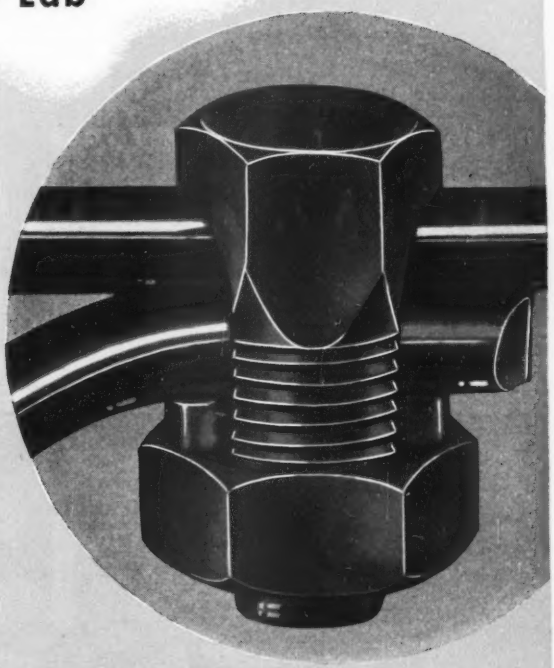
	1951	1952
Refrigerators	3,418,601	2,866,611
Electric ranges	1,093,030	760,220
Water heaters	569,931	462,069

Factory shipments of small electric housewares for the period were 11,051,923, against 10,970,000 for 1951.

(*Continued on page* 156)

Startling new connector performance...

from the Chemistry Lab



Here's News!... BLACKBURN has perfected an amazing new and exclusive chemical process—the CFC Process*—which drastically reduces thread friction... Result—over 25% increase in clamping force, to make the outstanding BLACKBURN Connector even better.

Tests show that high pressure connections on copper conductor have lower resistance—stay tighter—and give you lasting, trouble-free service.

This new discovery means that every BLACKBURN Hi-Strength Connector for copper connections *makes* and *holds* a *maximum-pressure* connection—an absolutely dependable connection that will stay tight and trouble-free year after year.

**CFC Processed for improved high-pressure connections*

**Chemical Friction Control Process—Patent Pending*

BLACKBURN *Hi-Strength* CONNECTORS

JASPER BLACKBURN CORP., 35 Madison St., St. Louis 6, Mo. • Phone CEntral 3007

FROM 1 HP. UP...

At JOPPA, all motors

THE MOTOR LINE-UP AT JOPPA

83 on pumps of all types

20 on fans — induced and forced draft, and ventilating

6 on air compressors

69 on crushers, conveyors, coal feeders, etc.

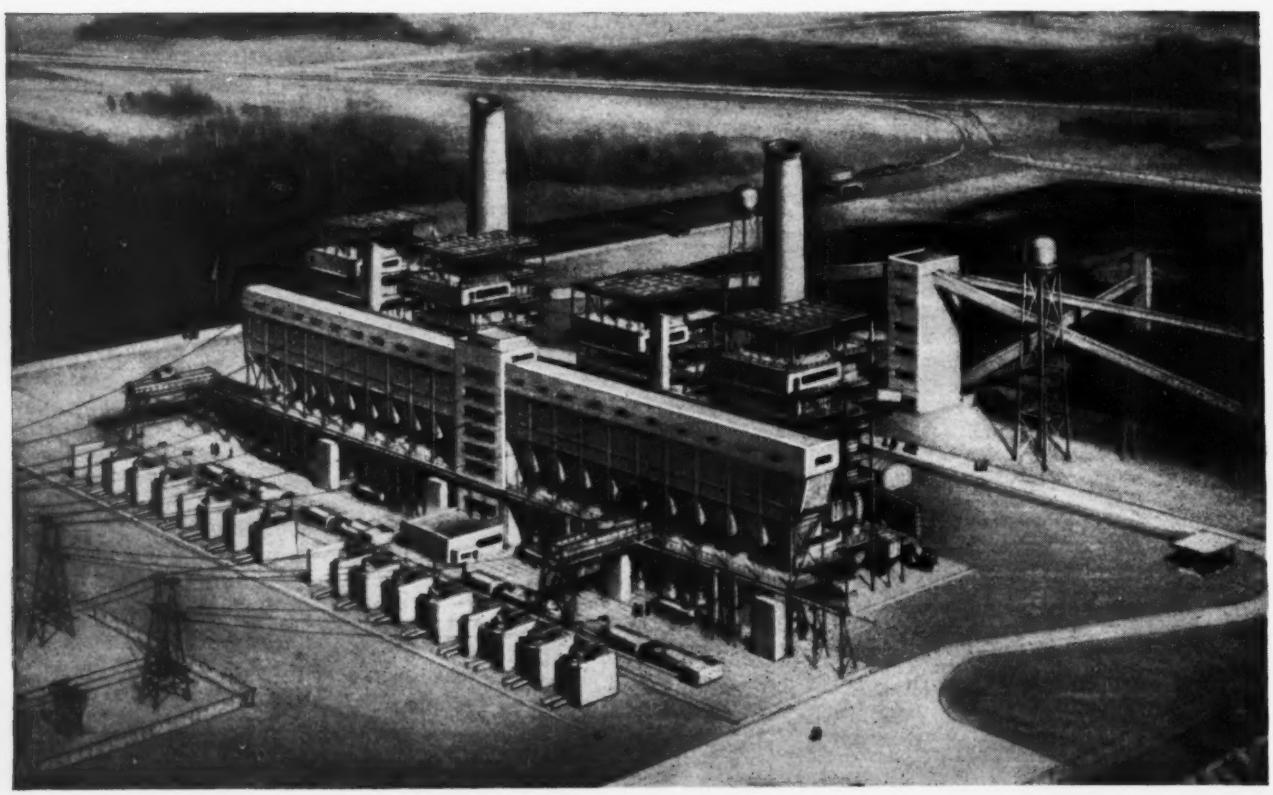
13 on winches, cranes, hoists

11 on miscellaneous service

MOTOR CAPACITIES IN HP include:
1, 1½, 2, 5, 7½, 10, 15, 20, 25, 30, 40, 50, 75, 100, 125, 150, 200, 250, 400, 600, 850, 1250, 2500.

MOTOR ENCLOSURES include:
dripproof, weather-protected (or outdoor splash-proof), totally-enclosed, non-ventilated, and totally-enclosed fan cooled.

MOTOR TYPES include:
synchronous, direct-current, squirrel-cage induction, and wound rotor induction.



are ELLIOTT!

The 652,000-kw Joppa Station, designed and constructed under the direction of Ebasco Services, Inc., New York, N.Y., is the largest outdoor steam-electric station ever to be initially conceived and built in one construction operation. Not only in capacity, but in construction speed too, Joppa sets a new record. Electric Energy, Inc., builders of the plant, represent the combined interests and efforts of the five major utility companies in the area to fill the vast power demand engendered by defense needs. Union Electric Company of Missouri, Central Illinois Public Service Company, Illinois Power Company, Kentucky Utilities Company, and Middle South Utilities, Inc., are the five companies who have pooled their resources to this end.

In this great new plant, all auxiliary motors are Elliott-built. Main auxiliary drives are served by sturdy "Fabri-Steel" motors produced by Elliott's Ridgway Division, while on other auxiliaries are many of the famous Crocker-Wheeler motors, built by the Crocker-Wheeler Division of Elliott Company.

For full details on Elliott Crocker-Wheeler and Elliott Fabri-Steel motors, contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

Q2-9

RIDGWAY DIVISION — CROCKER-WHEELER DIVISION

Freezer Shipments

(*Continued from page* 152)

NEMA emphasized that valid comparison between the two years is impossible on housewares because no figures were collected last year on bed coverings and heating pads.

Post-Graduate Schools in Commercial Cooking

Maximum advanced sales training for personnel of dealers and distributors of commercial electric cooking equipment and of utility sales organizations, will be offered by Hotpoint in a series of 11 three-day "workshops" 1953, the first starting March 3.

The workshops are offered as a post-graduate course for dealer, distributor and utility people who have previously attended a Hotpoint school or clinic. They will cover five district markets—industrial, institutional, school, restaurant and hotel mass-feeding operations. By teaching modern scientific food-processing techniques, the workshops will enable salesmen to meet food-service operators and chefs on common ground. Students will plan and cost menus for each basic type of operation and follow through by actual experience in preparing food.

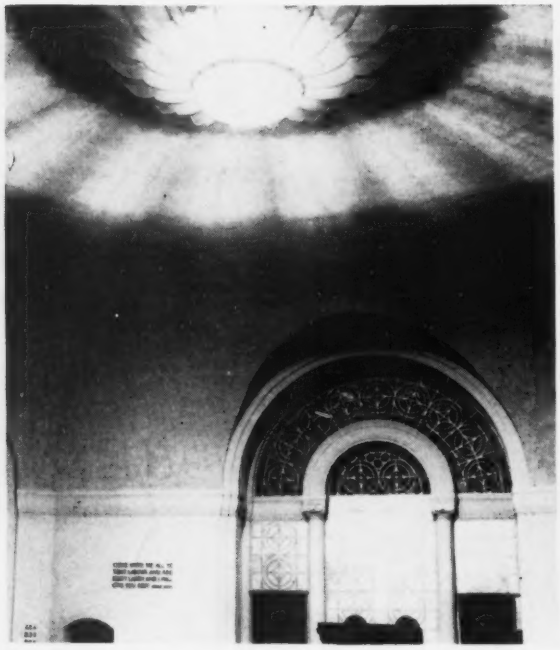
Room Air Conditioners

Utilizing the heat pump principle, a number of York Corporation's room air conditioners for 1953 will both heat and cool, according to an announcement made by John R. Hertzler, vice-president and general sales manager. These reverse cycle units, both window and console types, are available in the ¾ and 1-horsepower sizes.

He pointed out that "double use" could be made of these new room air conditioners the year round in California, Florida, and Gulf states.

Water Systems Month

Colorful posters designating May as "National Water Systems Month" will appear in dealers' windows after April 15. Particular emphasis in the promotion this year will be on replacement sales. While the market for original installations, estimated at 2 million farm and 7 million non-farm, is still very large, recent surveys indicate a market for 1.2 million systems to replace those made obsolete by increased water requirements in the past 15 years. In addition to posters for their windows, the promotional kits furnished to dealers include radio scripts and spot announcements for local broadcasts, newspaper releases, and copies of a booklet, "How To Make More Money Selling Water Systems."



BEFORE . . .

AFTER . . .

Recessed Fixtures Improve Church Lighting

Installation of 24 recessed fixtures and reducing the wattage of the 7-kw central fixture by 50% improved the illumination in the First Church of Christ Scientist, Sacramento, Calif. In the former system, the central fixture provided illumination at the hymn book level of from ½ to 10 ft-c. The new installation provides 15.3 ft-c average illumination throughout the auditorium.

The recessed fixtures are arranged in two concentric circles with eight 500-w fixtures in the inner circle and 16 750-w fixtures in the outer circle. Three of the fixtures in both circles nearest the rostrum are equipped with spotlights to illuminate the reader and rear wall.

Dimming equipment for control of the downlights and spotlights will be installed later.

the lid's off!

NEW electrical insulation made with DOW CORNING SILICONE RESINS

give you unequalled freedom in design, still more power per pound, even longer life and greater reliability

COATING VARNISH
Dow Corning Silicone Varnish 994
has over 100 times the thermal life of the best organic varnishes; over 3 times the life of earlier silicone varnishes.

IMPREGNATING VARNISH
Dow Corning Silicone Varnish 997
bakes without bubbling at 300° to 400°F; cuts processing time to 1/4 to 1/7 the time required for earlier silicone impregnating varnishes.

BONDING RESIN
Dow Corning Silicone Resin 2105
Makes it possible to produce silicone-glass laminates with over 100 times the dielectric life of the best silicone laminates previously available.

Electric machines built with Class H insulation bonded and impregnated with the original Dow Corning Silicone resins have 10 to 100 times the life, or half again as much power per pound as comparable equipment built with the next best class of insulating materials. That has been proved time and again during the past eight years by functional tests and by performance of thousands of industrial motors.

New Silicone Resins invented for you by our scientists and engineers have ***several times*** the dielectric life of the original silicone resins at high temperatures. That means that electrical equipment insulated with the new silicones will last even longer; give you still greater reliability; reduce motor maintenance and down time to the vanishing point; deliver more power per pound than ever before.

KEEP PACE WITH PROGRESS ..... Mail coupon today

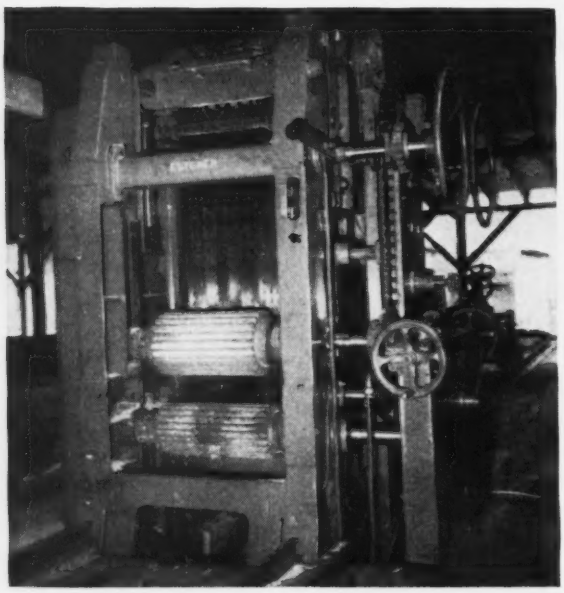
DOW CORNING CORPORATION
Midland, Michigan

DOW CORNING SILICONES

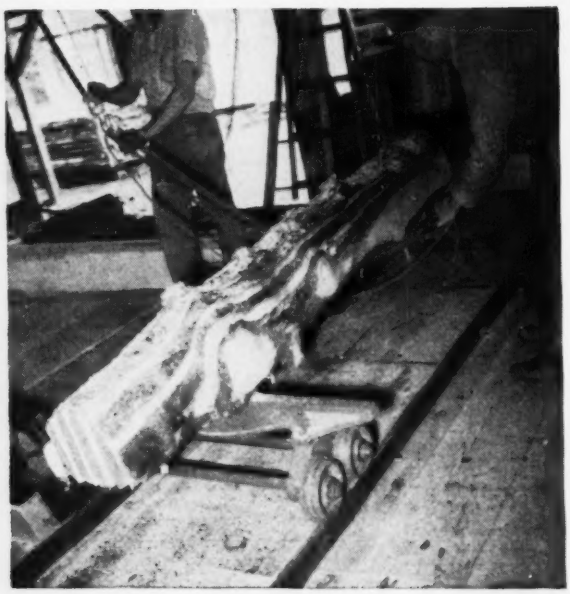
Atlanta
Chicago
Cleveland
Dallas
Los Angeles
New York
Washington, D.C.

Dow Corning Corporation, Dept. AY-2A
Midland, Michigan
Please send me complete data on ☐ BONDING RESIN
☐ COATING VARNISH ☐ IMPREGNATING VARNISH

Name _____
Company _____
Street _____
City _____ Zone _____ State _____



INFEED SIDE of the gang sash sawmill. Infeed rolls adjust automatically to size of log. Outfeed rolls on back of mill aid log movement



CUT LOG after passing through sawmill. Boards are placed on chain conveyor where they are inspected and delivered to edger

Gang Sash Sawmill Yields 33% More Lumber

GRAHAEME C. JAMISON, Industrial Consultant, Western Massachusetts Electric Co, Springfield, Mass.

The installation of a gang sash sawmill at the Wackerbarth Box Co, Granville, Mass. has increased the normal yield from logs about one-third over the conventional sawmill.

Basic difference between a conventional sawmill and a gang sash sawmill is that the former cuts off one board with each pass of the log through the machine while the latter reduces a log to boards with only one pass of the log through the machine. Using as many as sixteen blades, the gang sash sawmill can convert a log 2 ft in diameter and 15 ft long to boards in 1 min. The movement of material is costly and yet adds nothing to the final value of the product. In using the gang sash sawmill, the total distance of travel of the uncut portion of the log is only a small fraction of that required in the use of a conventional sawmill with a single blade.

According to Mr. Wackerbarth, owner of the company, there are other features of the gang sash sawmill which contribute to its high efficiency. In the ordinary sawmill, the log is fed through in a straight line to produce straight boards. If the log being cut is slightly curved, the first and last cuts produce only waste. With the gang sash sawmill the operator "worms" the log through following the shape of the log if it happens to be curved. The resulting boards bear the same curve as the original log but they can later be straightened out in the drying kiln under pressure. Also, by using thin blades to produce a finish cut, the waste or kerf loss is greatly minimized. Because of these advantages, logs which normally yield 150 board feet of lumber will yield up to 200 board feet when cut on the gang sash sawmill.

Machine controls are extended by cable to the operator's position at the rear of the log which is gripped in a device riding on the rails. The sawmill is driven by a 75 hp, 240-v, 3-phase induction motor located beneath the sawmill on the ground-floor level.

Infrared Heater Cuts Tile Working Time

EARL E. HAROLDSEN, Idaho Power Co, Boise, Idaho

A portable infrared floor heater has doubled the amount of asphalt floor tile work turned out per shift by the Sunset Floor Covering Co, Boise, Idaho, with one-third the number of men. In addition, a considerable reduction in fire hazard is accomplished by eliminating the open flame blow torch method formerly used.

Heretofore, three men were used on each shift—two men, each with a blow torch, and one man peeling the tile with a long handled peeler after it was heated. Through the cooperation of the Idaho Power Co, a portable heating utilizing 36-250-w infrared lamps was constructed.

The heater consists of a sheet of ¾ in. plywood, 42 in. wide and 48 in. long, covered with No. 20 gauge sheet metal. On this sheet of plywood is mounted six rows of infrared lamps, spaced 7 in. apart with six lamps per row spaced 8 in. apart in the row, Porcelain cleat receptacles are used to hold the lamps. All of the lamps are wired to a terminal block with No. 12 RH wire. A cable having 3 No. 8 wires 200 ft long is attached so as to feed the load at 120/240 v. The total connected load is 9 kw. Legs 13 in. long with glide casters are mounted on

(*Continued on page* 167)

City _____ Zone _____ State _____

Meet D. F. Shankle

Westinghouse Electric Utility Engineer*, who, on the next few pages, has some important apparatus considerations relative to the continuing problem of —

Well-regulated voltage . . . and your system revenue

*Mr. Shankle is an authority on utility equipment. He has spent many years in close association with apparatus design—and application of that apparatus to special situations. On the following pages, Mr. Shankle will introduce you to other experts of the Westinghouse Utility team, who have some practical answers to your voltage regulation problems.

"Voltage regulators, of course, are of primary importance in considering well-regulated voltage — so let's talk to 'Mike' Meixner, Manager Regulator Sales."

YOU CAN BE **SURE**... IF IT'S

"Simplified Westinghouse Controls and Tap Changers—your starting point for better regulation!"

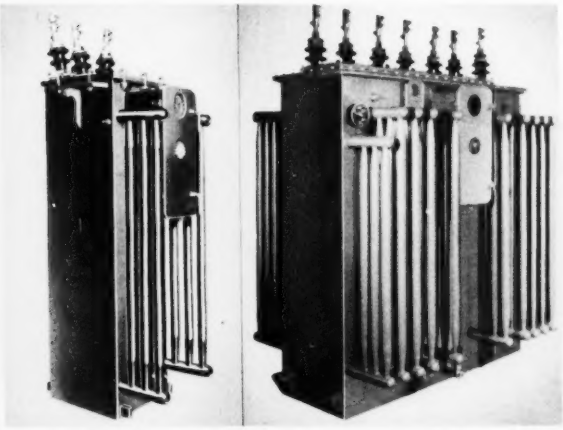
The inherent simplicity in design of these two important regulator components is your assurance of well-regulated voltages—from generating station to rural lines. The exclusive, new, all-electric control panels on Westinghouse Induction Regulators—the direct-drive tap changers on step regulators—give highly accurate regulation with an absolute minimum of maintenance. Westinghouse Regulators, including power, urban and rural types, are designed to accurately fit your exact requirement—whatever it may be.

The power line, for instance, includes the "SU" induction regulator for the lower voltage ranges. It also includes the "ST" triplex for 3-phase application. Both types feature the simplified all-electric control panels for smooth, sensitive control—with just a simple dial adjustment.

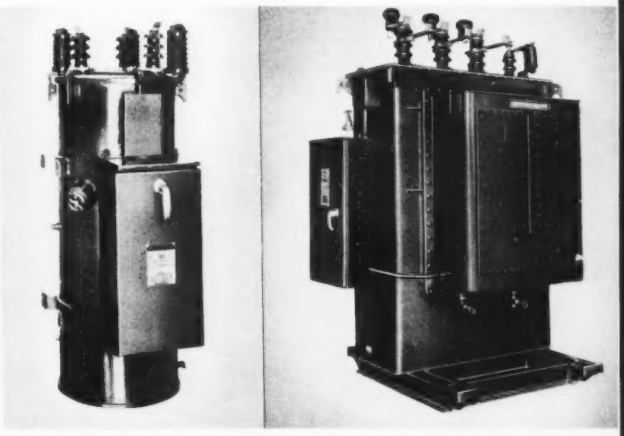
In the higher voltage ranges where regulation must be economically maintained, the type "URS" step regulator with Geneva direct-drive tap changers more than meets the requirement. Fewer moving parts assure accurate regulation—less maintenance!

Remember—all *three* types in the Westinghouse line of power regulators, as well as the many types of induction and step regulators available for urban and rural application, are designed to give you the utmost in well-maintained voltages.

Full details are contained in Catalog Sections 47-310, 47-350, 47-410 and 47-430. J-10395



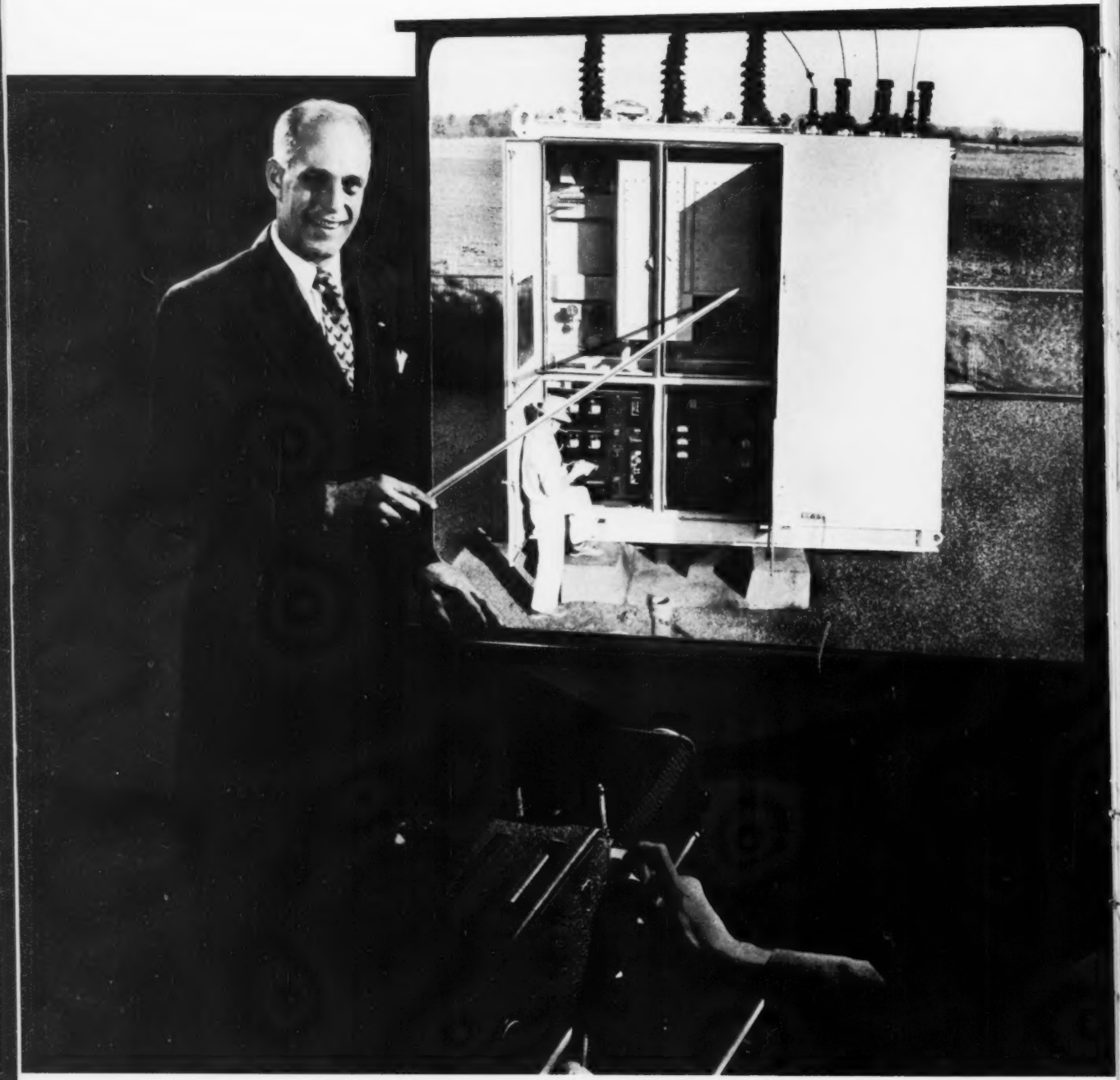
Induction regulator types "SU" and "ST" utilize new, all-electric control for simple dial adjustment, easy accessibility.



Step regulator types "URL" and "URS", with direct-drive tap changer, offer fewer moving parts, less maintenance.

Westinghouse

"To 'Tex' Brannan of the Transformer Division, 'built-in regulation' is synonymous with 'economical regulation'."



YOU CAN BE **SURE**...IF IT'S

"'CSP' Power Transformers . . . a logical answer to the cost-of-regulation problem"

When you're selecting voltage control for substations, two factors narrow your choice: degree of control required, and cost. For single-feeder substations, "CSP®" Power Transformers simplify that problem.

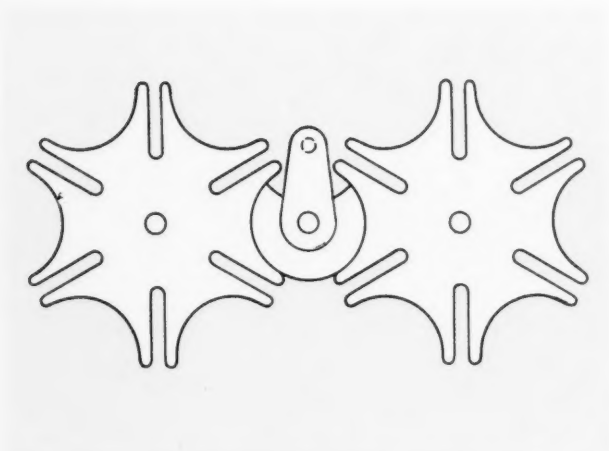
Along with complete protective and metering equipment, "CSP" Power Transformers have automatic under-load tap changers, designed and built into the unit. Because they are engineered and manufactured together, a degree of coordination is achieved that would be hard, if not impossible, to equal in any field-erected station. It's a natural advantage that results in the best possible regulation.

"CSP" Power Transformers offer two distinct cost advantages, too.

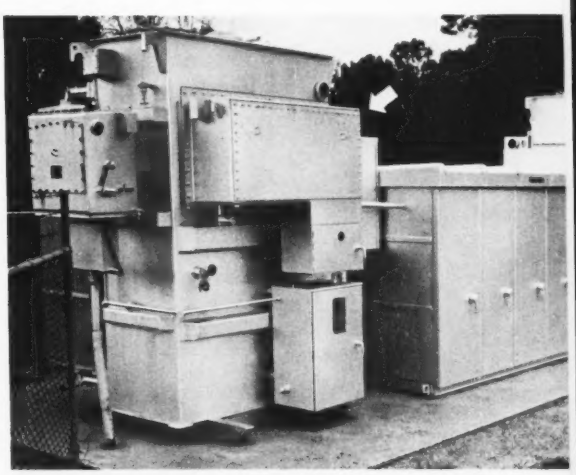
Installation cost is lower because they require only one foundation and one set of connections. Compare this with the thirty to forty items that must be connected in field-erected stations.

Maintenance costs are lower, too. The type "URS" tap changer is unusually maintenance-free because of the basic simplicity of its design. The direct-connected drive eliminates latches, springs and shock-absorbing devices. The Geneva gear action of the moving contacts causes smooth acceleration and deceleration, with high speed during the arcing cycle. This minimizes arcing; provides shockless operation.

It all adds up to the best level of voltage control obtainable with step-type regulation, plus installation and maintenance savings no other equipment can equal. In addition, neat appearance and inherent safety often overcome community objections to substations, solving costly real estate and landscaping problems. Your Westinghouse representative will be glad to discuss specific applications, or write direct for Booklet B-4692. J-70681.



This is the Geneva gear that guides the moving contacts of the tap changer. It assures shockless acceleration and deceleration with high speed through the arcing cycle. The result is a virtually maintenance-free drive. Tests have been conducted, proving more than a million operations without serious contact wear.



Automatic under-load tap changers can help cut regulation costs in your multi-feeder units, too. The above double-ended station has its switchgear factory coordinated with two 3,000-kva transformers. Arrow indicates tap changer compartment of the transformer in the foreground.

Westinghouse

"Here's Bill Sumner of the Transformer Division with a workable approach to an old problem:"

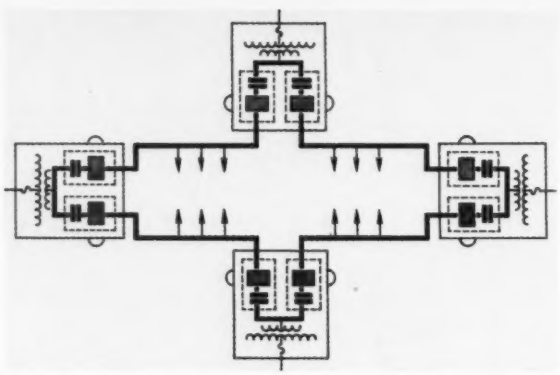
"Flicker-free service made practical with 'CSPB' Transformers"

It's generally agreed that an effective way to stop service voltage complaints is to hook up distribution secondaries in parallel. But even though this can hold instantaneous dips within acceptable limits, it creates problems in fuse coordination and cascading black-outs that usually outweigh the advantages. That's why Westinghouse developed "CSPB" Transformers.

In banking with "CSPB" Transformers, secondaries are interconnected through two built-in breakers, one to serve each direction that the secondaries extend. This provides signal-light indication of overworked sections, then automatically isolates the area if the overload becomes dangerous, or the section is faulted.

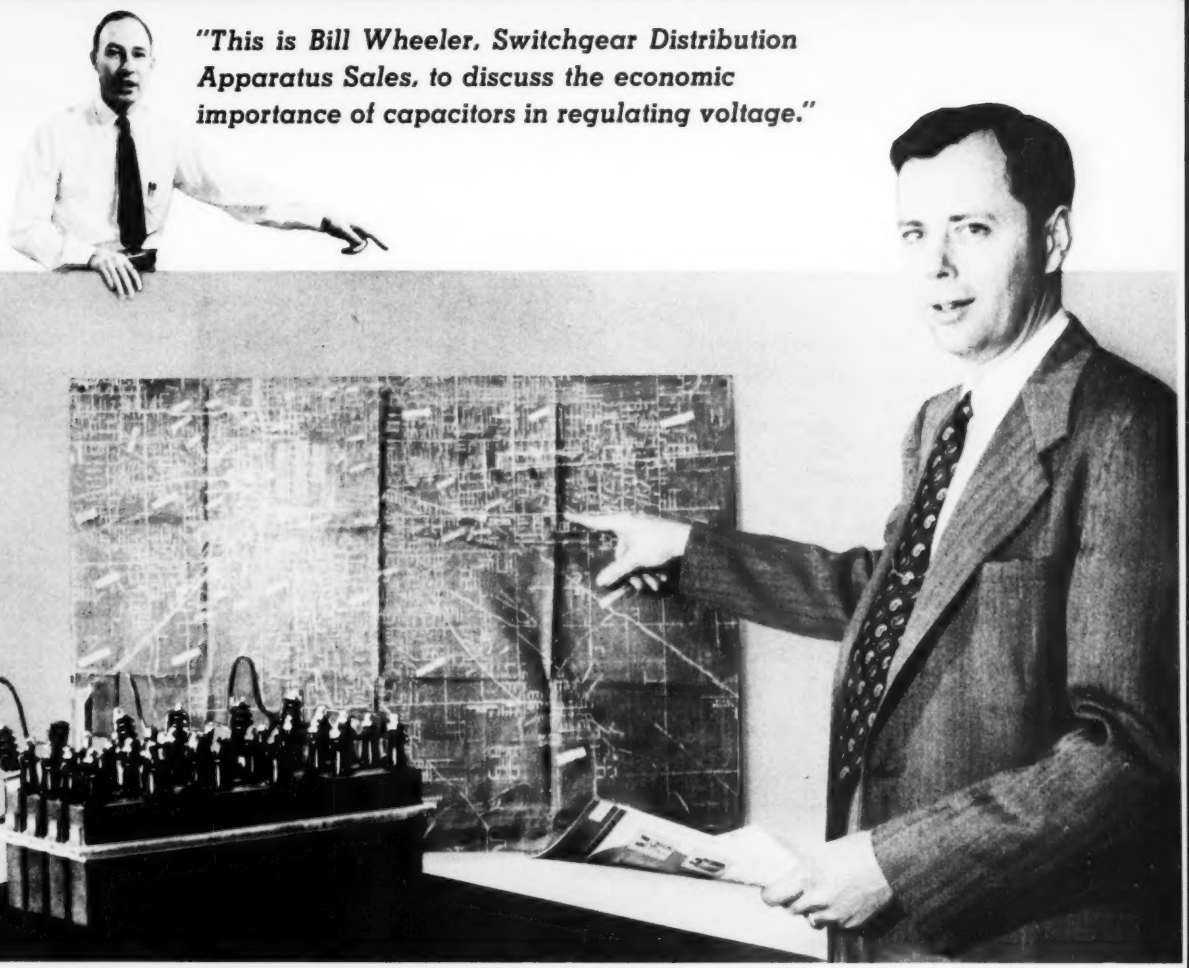
Because of this feature, "CSPB" Transformers continue to serve the bank, even though one section may be out. This makes it unnecessary to install excess reserve capacity . . . and as load grows or shifts, capacity can be added easily by simply tying in more transformers. With complete lightning and thermal protection built in, installation costs are low. With only one hookup instead of three or four, savings in crossarms, copper and labor are substantial.

No matter how effective regulation may be up the line, it's the service level where voltage problems are *customer* problems. "CSPB" Transformers make it practical and economical to install the type of system that eliminates these problems. Talk it over with your Westinghouse representative, or write for Booklet B-4310A. J-70682



Banked Secondary System using "CSPB" Transformers provides reserve capacity . . . prevents cascading through system.

YOU CAN BE **SURE**... IF IT'S


"This is Bill Wheeler, Switchgear Distribution Apparatus Sales, to discuss the economic importance of capacitors in regulating voltage."

"Westinghouse switched capacitors offer hidden opportunities for better voltage regulation"

If you serve spread-out areas, there may be great opportunities for you in Westinghouse Autotrol* . . . automatically switched capacitors. Many utilities with problems similar to yours are using Autotrol to improve voltages during heavy load periods. Autotrol costs as little as $5.66 per kvar and it frequently returns its first cost in a short time by reducing losses and opening up more system capacity.

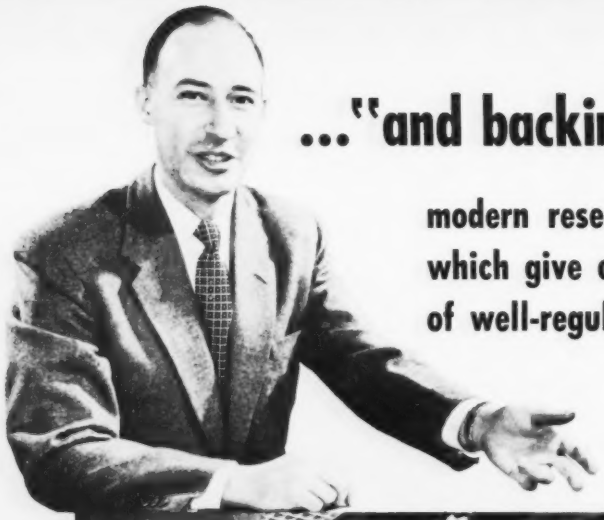
The first step in making these low-cost improvements is a study of your system. Westinghouse has a wealth of data on capacitor applications which is available to you. We make a complete line of capacitor equipment, including non-switched units which can easily be converted to Autotrol, if desired, at a later date.

Autotrol switches in automatically when the system needs kvar. Switching can be controlled by a simple voltage, current or time device. We can help you decide which is best for your application. The Westinghouse switching equipment is the simplest and most dependable available today.

Think about your system and your regulating problems. Then have Westinghouse tell you more about Autotrol. Write now for Descriptive Bulletin 49-310 and Reprint 4844. J-60813.

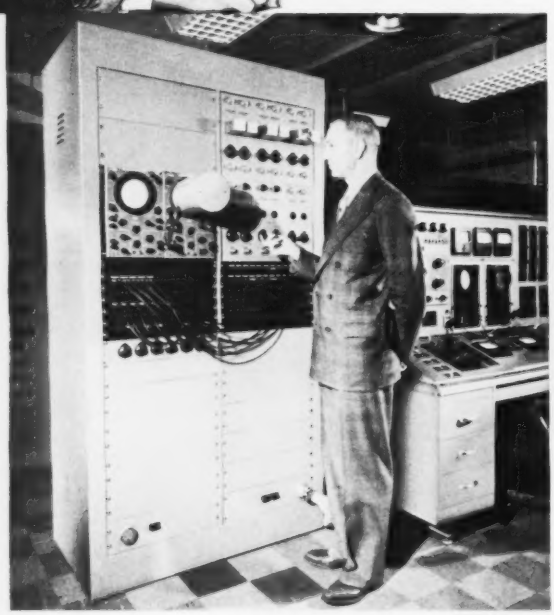
*Trade Mark

Westinghouse

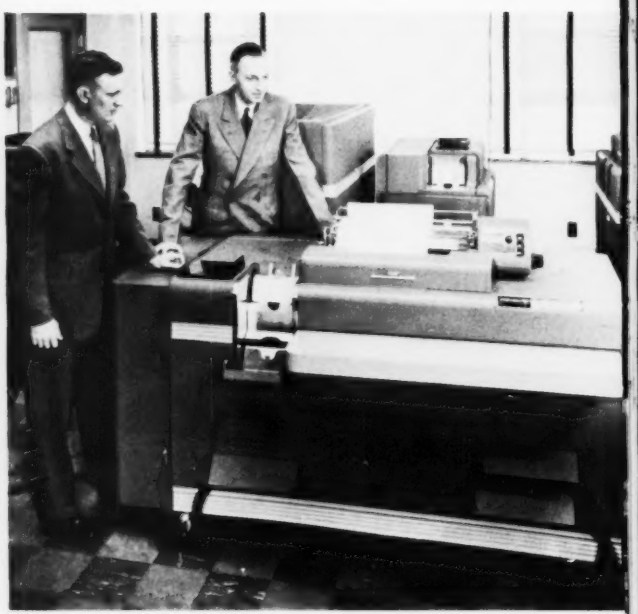


..."and backing up these products are...

modern research computers like these — which give continuing assurance of well-regulated voltages!"



Analog computers—"Anacoms", as Dr. Harder of the Analytical Section calls them, make possible the solution of problems that would take hours, weeks or even years to solve by ordinary means.



Digital computers—Mathematical operations are performed by counting pulses on a counting wheel, relays or electronic tubes—in effect, a complex version of the modern office machine.

Both the Analog and Digital computers combine at Westinghouse to solve system problems in (1) basic equipment design, (2) application of equipment to special situations such as maintaining well-regulated voltages.

For example, the Analog computer has been used to determine transient voltages which occur when switching capacitors, and to limit these voltages to reasonable values by proper application of equipment.

Such data and equipment add to your assurance of satisfied customers.

If you have problems of maintaining well-regulated voltage—call your local Westinghouse representative . . . he's equipped to discuss and help you with your specific situation. Copies of this insert or the product booklets referred to on previous pages can be obtained by writing direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. CP-1001

YOU CAN BE **SURE**...IF IT'S **Westinghouse**

each of the four corners and a skirt 12 in. long, (within a ½ in. of the floor) is installed to prevent air circulation. Distance from face of lamp to floor is 5¼ in. One man, with the aid of a long handled peeler, merely pushes this along the floor ahead of him and peels the tile as he goes.

This installation was first used at the Mountain Home Air Base, Mountain Home, Idaho, on the renovating of a number of barracks buildings. The District Engineer, Army Engineer Corps, Walla Walla, Washington, expressed complete approval of this method and indicated that all future specifications prepared by his office would specify that the tile must be removed by this method.

An additional use has been found for this portable heater, particularly in the winter time. New asphalt tile installations are set by applying radiant heat to the surface of the tile so that it will go down evenly. One man, with a linoleum roller and this heater, can cover a large floor area in a short time. The 200-ft cable permits its use on any size building by connecting it directly to the main switch.

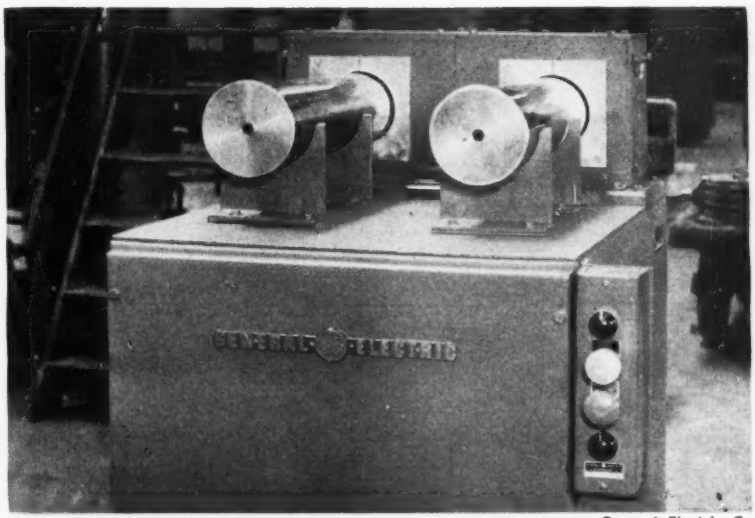
Induction Annealing Aids Ammunition Reclaiming

The Ordnance Ammunition Center of the U. S. Army at Joliet, Illinois, has purchased mouth-annealing equipment for installation at eight locations throughout the country in a dollar-saving program of reclaiming old ammunition of 40, 75, 76, and 90 millimeter calibers.

Purpose of the program is to reload shells that have become unreliable because of age. To reclaim the outdated shells, the projectiles and powder are removed from the cartridge cases and the mouth of the brass casing softened by induction annealing. This insures a sung fit against the grooves of the projectile when the cartridge cases are refilled and again crimped on the projectile.

Each of the eight installations will consist of a 30-kw, 10,000 cycle motor-generator set with controls, and 2 two-position induction annealing machines which are designed to anneal cartridge case mouths at the rate of 600 per hr.

Two machines are used at each installation so one can cool and be reloaded while the other is going through the 11-sec heating cycle. The machines are so constructed that the induction heating coils may be interchanged to accommodate shells of different caliber.



General Electric Co

MOUTH-ANNEALING brass cartridge cases of old ammunition with two-station induction heating machine insures snug fit against grooves of projectile when cases are refilled and again crimped on projectile

INDUSTRIAL BRIEFS

Separating sand from aluminum match plates by the use of strip heaters has resulted in a higher percentage of satisfactory castings and increased output at the Canton Malleable Iron Co, Canton, O. Three 150-w strip heaters, mounted beneath a metal plate, radiate sufficient heat to warm the aluminum plate between molding so that the sand and plate readily separate. G. W. Craiglow, Industrial Power Eng. Ohio Power Co, Canton.

Drying time cards with two 250-w infra-red lamps at Goebel Brewing Co, Oakland, Cal., has eliminated time clock clogging and smeared printing. Bottle washing department has considerable moisture due to steam. Men's damp hands caused trouble. One lamp is on "In" cards, and other on "Out" cards. Lamps burn 24 hr daily—264 kwhr per month. Operating cost is approximately $2.25 per month. G. E. Hersam, Industrial Power Eng., Pacific Gas and Electric Co., Oakland, Cal.

Copper brazing and bright annealing in a conveyor type electric furnace at the Larson Tool & Stamping Co, Attleboro, Mass., provides precise temperature control, atmosphere protection, increased speed of production and a stable, high quality product. Company has installed a 75-kw conveyor type furnace equipped with ammonia dissociator for bright annealing of shell cases. Furnace and conveyor are 43 ft long and operate at 230 v, 3 phase. It is capable of processing 200 lb per hour at 2050 F. Furnace is also used for copper brazing shell clips. George B. Newton, Power Sales Engineer.

Water heating by 30-kw electric water circulating heater saved 720 man-hours monthly plus a cost reduction of 50% at the Lehigh Portland Cement Co, Fogelsville, Pa. Company formerly had a 1200-gal uninsulated water tank, heated with coal, and maintained by three men. During three daily shifts, tank provided 100 F shower water for 106 to 125 men. Conversion for electric operation was accomplished by installation of electric heater with all necessary controls, and insulation of tank. W. J. Zboyovsky, Industrial Rep., Pennsylvania Power & Light Co, Bethlehem, Pa.

NEW EQUIPMENT

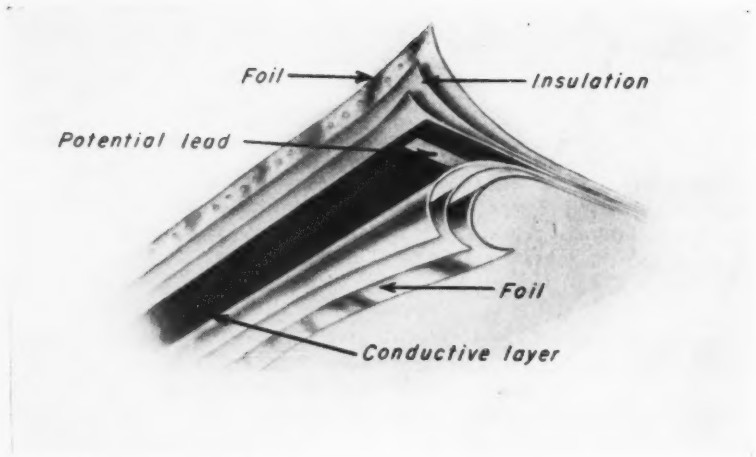
Pin-Type Insulator

Molded from tempered glass with a dielectric constant of 7.5. It is claimed that the new design gives a minimum build-up of corona and longer leakage paths offer better performance in contaminated atmospheres.

Mechanical tests performed according to A.S.A. standards showed the impact, cantilever, thermal shock and torque strengths to be very good. Electrical tests show values in excess of AIEE standards. There have been no failures of the insulator under the most severe maximum voltage impulses applied.

They are available in three voltage ratings of line construction of 6.6, 8.0 and 13.5 kv.

Kimble Glass Co, Toledo 1, Ohio



Heating Panel

Called Uskon, is $\frac{1}{16}$-in. thick, weighing 6 oz per sq ft and used for electrical radiant heating. The panels are bonded to ceilings of plaster, sheetrock or similar smooth material by means of a special adhesive. Where electricity is available for 1½¢ per kwhr or less, the cost of operation is said to be comparable with that of other fuels.

Three sizes of panels are available, 4x6 ft, 4x4 ft, and 3x4 ft. Both outer surfaces are covered with aluminum foil to keep out moisture. The panels are rated at 22 w per sq ft (75 BTU's and are available for 115 or 230v.

Due to the absence of abnormally high temperatures at concentrated points, hazards from burns and scorching are eliminated. It is claimed, the temperature of the ceiling panels averages about 110 deg and heat rays warm the floor and other objects in the room without heating the air.

United States Rubber Co, New York 20, N. Y.

Radio Meter

Used in the maintenance of two-way radio systems to help maintain transmitters and receivers on their assigned frequencies, as required by the FCC.

Type ST-13-A measures modulation swing and carrier frequency of FM transmitters, featuring both high and low RF output for receiver alignment. It is available with either one or two crystals, for servicing single- or two-frequency systems in the low and medium bands. Crystal tolerances range from 0.0005 to 0.0025%.

A crystal oven is also available in two ratings, 38 and 75 C. It is powered from any external six-volt power source.

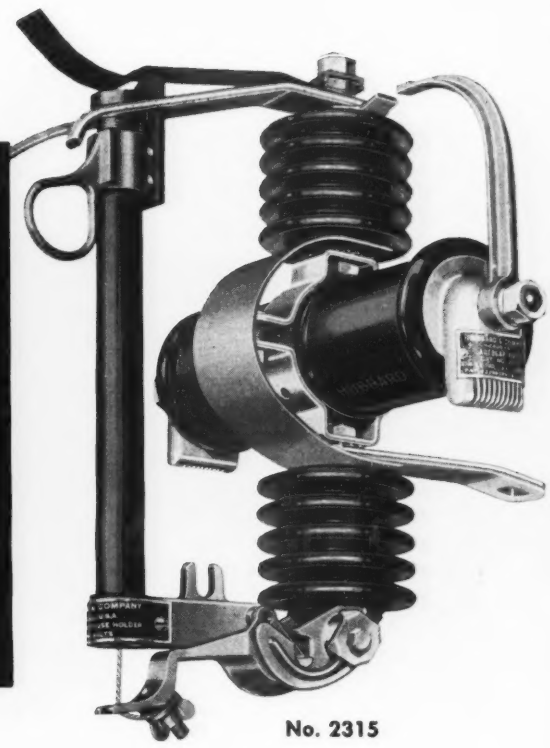
General Electric Co, Syracuse, N. Y.

Silicone Resins

Identified as Dow Corning Silicone Resin 994, 997 and 2105 designed for coating glass cloth, impregnating Class H equipment and the third for bonding glass laminates. Claimed to have superior thermal life, as indicated by retention of their dielectric properties

(*Continued on page* 172)

You Get These 7 Advantages in the HUBBARD One Unit Autogap Fuse Cutout *with Drop-Out Fuse Holder*



No. 2315

Patented—Trade Name Registered

1. Unit construction means low initial cost; single, low installation cost; minimum space requirement.
2. NEMA standard bracket, Hubbard No. 2337, is furnished for pole or crossarm mounting.
3. A section of the fuse cable is exposed at the bottom of the Drop-Out mechanism so that, without accessories, standard fuse links up to 50 amperes may be mechanically disconnected without external arcing.
4. Time proven maximum lightning protection is provided by the standard 9 KV Autogap Arrester.
5. The Autogap Fuse Cutout is protected by Bakelite bird guard covering bracket.
6. The heavy duty, weatherproof fuse holder is positive acting.
7. Properly designed guides and large bearing surface assure positive closure of Drop-Out mechanism from any angle.

Write for additional technical information

HUBBARD AND COMPANY

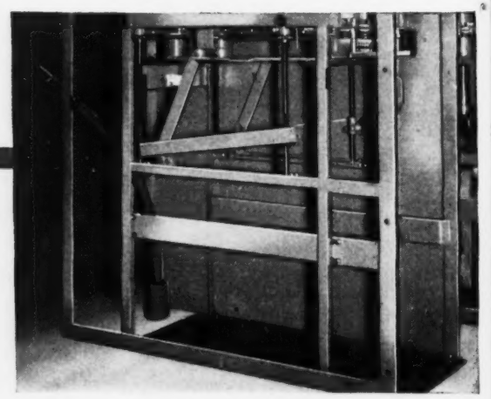
ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

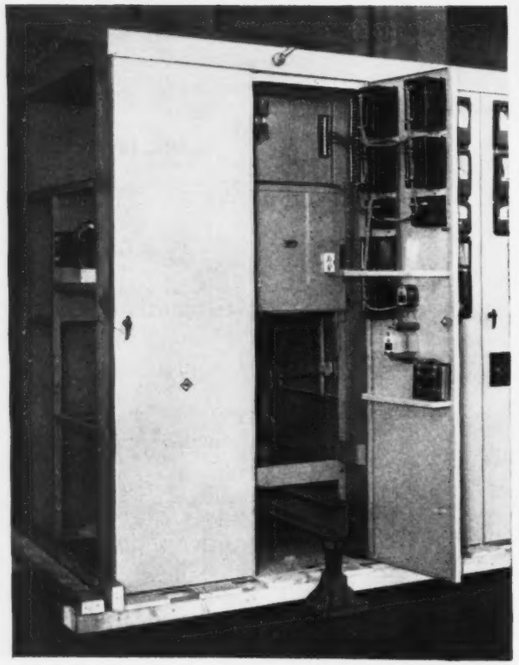
"Hang the Load on Hubbard Hardware!"

Simplifies

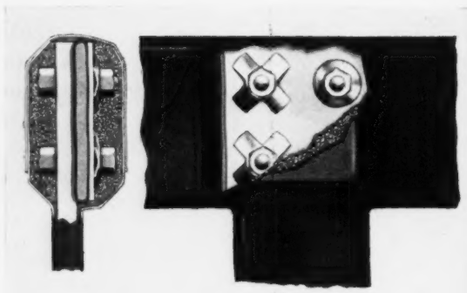
ALLIS-CHALMERS
METAL-CLAD
Switchgear



PLACING Switchgear over floor cable is done without lifting cubicles because A-C engineers designed the cubicle in such a way that it simply slides into place.



MOVING is an easy job even if there's no crane or overhead space. Installation-wise A-C engineers built in provision for jacking all indoor Switchgear units.

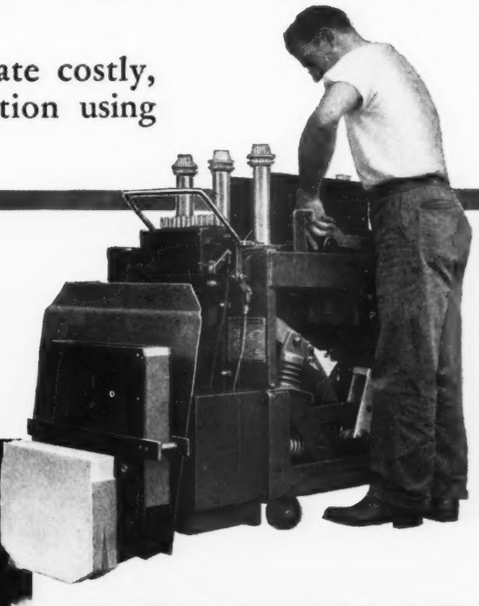


JOINING buses need no longer be a long, time-consuming job. Joint is bolted; then, no-corona tape is placed over bolt heads and nuts. Next, a molded Neoprene boot is slipped over the joint and taped in place. No fuss, no muss, no liquid compounds.

ALLIS-CHALMERS

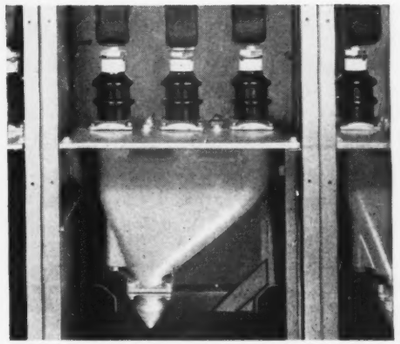
Installation!

Here are six ways you eliminate costly, time-wasting steps in installation using Allis-Chalmers switchgear.



INSPECTING contacts and arc chute during and after installation is only a three minute job with latest Allis-Chalmers circuit breaker. Only one nut to take off and all barriers can be lifted right out.

ALIGNING is easy. Allis-Chalmers builds every removable element and every stationary element to master jigs. This simplifies installation, and makes all units of same rating interchangeable.



INSTALLING a pothead can be done out in the open where there's plenty of room. After that it is simply pushed into place and bolted. No crossbars prevent swinging the pothead into place.

THESE are only details, but they do tell a story of careful engineering. It will pay you to find out more about Allis-Chalmers Switchgear. Call your nearby A-C District Office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3888

leading photoelectric control

FOR STREET LIGHTING

The F-P Series 63300B Control is the latest unit in a proven line of photoelectric controls for street lighting that have been operating successfully on lighting circuits for over seven years. Today there are more than 35,000 F-P Controls in use by over 700 utilities.

Fisher-Pierce has maintained leadership in photoelectric street lighting control through:

PERFORMANCE — F-P Controls provide street lighting safety because lights are on *when needed*, regardless of time of day. Because the control is photoelectric, it depends only on natural light values for operation. There is no mechanical device to get out of phase with actual daylight conditions.

ENGINEERING — The F-P Series 63300B circuit and technical operating features are the result of years of field experience. The development work and testing was performed in conjunction with utility engineers. The Fisher-Pierce organization is in a position to help utilities in planning, installing and maintaining control systems.

ECONOMY — F-P Controls provide true economy: purchase price and cost of installation are low. Maintenance is practically negligible as compared to other control methods. To give you a picture of this F-P economy, we will be glad to refer you to some of our customers who have had extensive field experience with these controls.

Write for Bulletin 63300B.

FP

The FISHER-PIERCE CO., Inc.

82 Pearl St., So. Braintree, Boston 85, Mass.

EXPORT: PHILIPS EXPORT CORP. 100 E. 42nd STREET NEW YORK 17, N.Y.

IN CANADA: NORTHERN ELECTRIC CO., Ltd.

Silicone Resin

(*Continued from page* 168)

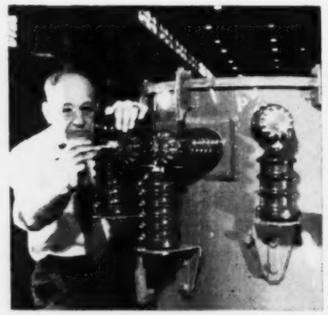
after long exposure to high temperatures.

Resin 994 is described as having over three times the thermal life of earlier silicone resins designed for this purpose. Initial dielectric strength is from 1,600 to 1,900 volts per mil. Dielectric constants at 25 C are 2.8 for both 10^5 and 10^6 cycles. Power factors at 25 C for 10^5 cycles is 0.0015 and for 10^6 cycles 0.0014.

Resin 997 is an impregnating varnish that can be cured without bubbling in an air-circulating oven at 300 to 400 F. Curing time is only ¼ to ½ that previously recommended and the graduated care formerly required can be eliminated, it is claimed.

The third resin, 2105, for silicone-glass laminates, has 100 times greater dielectric life.

Dow Corning Corp, Midland, Mich.



Cascading Regulator

For constant current and street light control, a relay is incorporated in regulator. With this system, the only human act required to turn on city's lamps is the closing of one switch. This energizes the nearest regulator that turns on some lamps and energizes relay of another regulator, etc. **Westinghouse Electric Corp, Pittsburgh 30, Pa.**

Electric Oven

Has eight compartments, is portable and is model PL 2A. It is used for drying, baking or pre-heating different sizes or types of product.

Claimed to feaure low operating cost of less than 5¢ per hr, adjustable temperature control to 325 F, opera-

ICE CAN MAKE A "HOT LINE" COLD

IF SUSPENSIONS CAN'T STAND THE STRAIN!

Purified Porcelain is good insurance against the hazards of winter. This finest insulator porcelain ever made has unequalled ability to stand stress and strain. Cement is specially compounded and caps and pins are scientifically designed for maximum strength. Victor insulators withstand pull of ice, snow, high winds and endure thermal variations far above NEMA standards. For engineering data on these and other Victor *Purified Porcelain* insulators, send for Bulletin No. 4.

Every Victor Suspension Insulator undergoes this routine tensile test before electrical flashover test.

FREE BOOKLET gives you the full story on how Victor Insulators are made — how and why *Purified Porcelain* was developed. Write us for your copy.

VICTOR NO. 900 SUSPENSION

Specify VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

High Voltage Fittings • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain

★ **SUBOX PROTECTS . . .**

maximum resistance to rust, weather, steam, moisture, condensation, oils, and cleaners.

★ **SUBOX DECORATES . . .**

metallic finishes right in the *first coat* — no overcoat is necessary. One Subox color for all structural steel creates harmony.

★ **SUBOX SPEEDS WORK . . .**

self-priming means fewer coats. A single coat for interiors and a double coat outdoors gives adequate protection.

★ **SUBOX REQUIRES NO UNDERCOAT . . .**

durable lead base in Subox paints allows repainting again with the same material or acts as enamel undercoat.

★ **SUBOX CUTS COSTS . . .**

no priming touching up is necessary in interior shop-coated steel before applying Subox paints.

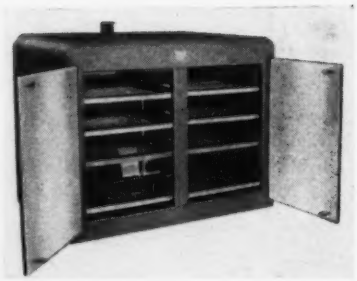
SPECIFY SUBOX . . .

time-tested for more than 25 years

★Write today for your free copy of informative article on how to cut painting costs with "Plan Painting."

Subox Inc.

3 Fairmount Plant Hackensack, N. J.



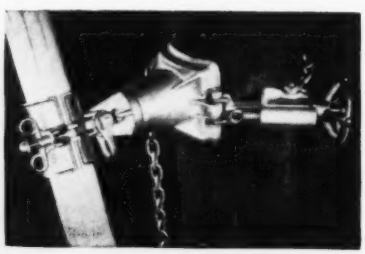
tion from 110-v ac outlet, fan driven forced circulation of air that forces moisture out and adjustable damper for control of temperature.

The oven is 30-in. wide, 25-in. deep and 24-in. high, outside measurements. Exterior is heavy gauge steel, contoured formed for strength. Insulation is Asbestos Aircell. The oven can be equipped with an outside reading thermometer, timer, red pilot light that shows when heating elements are on, oven stand and thermostat control. **Grieve-Hendry Co, Inc, Chicago 12, Ill.**

Insulating Varnish

Designed for equipment where high speeds and intense vibration would cause wire movement, resulting in electrical failures. Claimed to have outstanding mechanical strength even at Class B temperatures.

In addition to its mechanical strength, Irvington No. 140's resistance to oils, chemicals and moisture is said to be equal to the best obtainable. Its electrical properties, and its storage and dip tank life are exceptional. It can be diluted with naptha, thus reducing thinning solvent costs. **Irvington Varnish & Insulation Co, Irvington 11, N. J.**



Tong Saddles

Have aluminum for bulky parts and high tensile alloys for highly stressed parts. They are used in conjunction

This continuous roll machine at the C-D-F, Bridgeport, Pa. plant makes top quality sheet fibre for electrical insulation. Corrosion-resistant rollers are made from laminated Dilecto, another famous C-D-F product.

CDF

DIAMOND VULCANIZED FIBRE

- mechanically and electrically strong
- moisture, arc and chemical resistant
- high dielectric strength
- easily machined and formed
- low-cost with long life

watched all the way... DIAMOND VULCANIZED FIBRE

Naturally it takes a big, well-equipped company like C-D-F to make fibre. It also requires a special brand of know-how and long experience to take rag paper (we make our own), zinc chloride and water and come up with a low-cost uniform product that can be adapted to a million uses.

Maybe you think that vulcanized fibre has been replaced by many newer, more publicized materials. Actually Diamond Vulcanized Fibre today has more applications, more unique qualities, more product design value than ever before.

If you need a dependable source for bone, commercial, Diamond "fish paper" insulation, tubes, rods, receptacles . . . talk to the man who knows . . . your C-D-F sales engineer (offices in all principal cities), or write C-D-F, Newark, Delaware.

THE NAME TO REMEMBER CDF DIAMOND VULCANIZED FIBRE

Continental-Diamond Fibre Company

NEWARK 15, DELAWARE

5 reasons for specifying RT&E TRANSFORMERS

5 HIGH IMPULSE LEVEL
Impulse level with built in safety factor considerably exceeds industry standards and is accomplished by—low layer insulation voltage stress—stepped back and graded overinsulation—space wound windings at coil ends—taps positioned in center of H.V. windings.

4 OIL FILLED PRIMARY BUSHINGS
Primary bushings are a wick-fed oil-filled type to eliminate corona and radio noise.

3 EXTERNAL TAP CHANGER
All tap changers are externally operated to avoid opening of unit—breaking of factory cover seals—contamination of oil from moisture and dirt—provides a greater convenience for tap changing and tap position identification in a matter of seconds. Unit remains sealed for longer life.

2 STANDARD 5 YEAR GUARANTEE
All RT&E transformers are guaranteed for 5 years from date of shipment from factory, free from defective workmanship and materials.

1 D. B. P. C. (inhibited oil)
All RT&E transformers are inhibited with D.B.P.C. to reduce oxidation —sludge—corrosion—acid formation and to increase transformer life.

SIZES
3 THRU 500 KVA
2400 TO 14,400 VOLTS
SINGLE & DOUBLE BUSHINGS

WRITE FOR CATALOG

632 N. 8TH ST. MILWAUKEE 3, WISCONSIN

RT&E Co.

BRANCH PLANT: WAUKESHA, WISCONSIN

with wire tongs and auxiliary arms to move and support line conductors. Working load is 500 lb.

Features claimed in this design include:

1. Greatly reduced weight with more than adequate strength.

2. Convenience of installation. Saddle will fit almost anywhere, such as between cross arm braces. Tightener is installed with only two movements—hooking the chain and spinning the nut tight.

3. New 4-in. extension can be installed or removed in only a minute or two. Increased clearance between pole and wire tong (7¼ in.) usually makes extension unnecessary.

Saddles are available with from 1¼-in. to 3-in. pole clamps. Individual components are also available. **Bodendieck Tool Co, Taylorville, Ill.**

Ladder Support

Enables man to work 32 ft in the air. The ladder can be erected by one man in 10 second, they claim. A casing strengthens the ladders bottom section and bars lock into and brace the casing. Ladder feet seat in pockets in the back step.

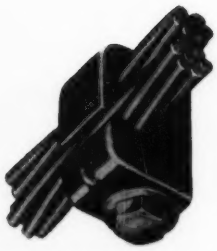
Gordon Metal Products Co, Lapaz, Ind.

Tester Kit

Designed for maximum versatility, the Knight VTVOM has 6 ranges for measuring ac peak voltages, 6 milliampre ranges and 5 capacitance

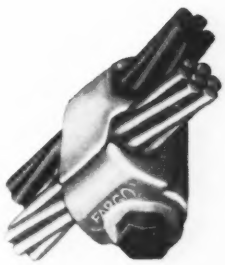
(*Continued on page* 180)

There's a *One-piece...Vise-type* *FARGO CONNECTOR* to meet your "specs" *plus* performance...ease of installation ...overall economy.



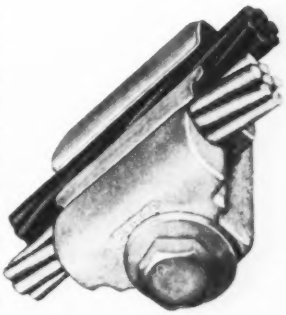
THE "5000 Series" FOR COPPER CONNECTIONS: Fargo's Standard Connector—obtainable in bronze or plated bronze. Its vise-type construction provides an ideal . . . vibration proof contact —high in conductivity . . . with high compression at low wrench torque. It is easy and safe to handle . . . requires no attention after installation—can be used over and over again. Available from #8 sol. to 1000 MCM.

THE "8000 Series" FOR ALL-PURPOSE CONNECTIONS: This series utilizes a bronze body and copper spacer for copper conductors. Also plated for all-purpose use and for friendly contact with aluminum. Liberal spacer provides adequate conductor spacing minimizing galvanic corrosion of dissimilar conductors. Fits wide range of conductor sizes—thus reducing the number of connector sizes to be stocked.



THE "7000 Series" HEAVY DUTY CONNECTOR: This series is designed with wide jaw contact areas and has better-than-conductor resistances. It is equipped with a heavy copper spacer that is massive in design for better heat dissipation during faults. Available in bronze for copper connections—or plated for all-purpose use in sizes from #6 to 1000 MCM. Also available in aluminum for Al. to Al. or Al. to Cu. in sizes from 350 MCM to 1000 MCM.

THE "9000 Series" FOR ALUMINUM-TO-ALUMINUM or ALUMINUM-TO-COPPER. This series features all-aluminum construction with wide jaws for better contact resistances . . . low relaxation or cold flow of conductors. Massive design provides for better heat dissipation under faults — like metal contacts increase service life. Available for aluminum and copper combinations in sizes ranging from 8 sol. to 397.5 MCM.



...*"built like a vise — grip like a vise."*

Ask your Line Material Field Engineer to give you complete details.

FARGO

Manufactured by

FARGO MFG. COMPANY, INC.

Poughkeepsie, N.Y.

Distributed by

LINE MATERIAL COMPANY

(A McGraw Electric Company Division)

Milwaukee, Wisconsin

"Experience showed us how FUSETRON FUSES Prevent Motor Burnouts . . . now we protect all Motors on our Units with them!"

Franklin Van Reed
Production Engineering Supervisor
ORR & SEMBOWER, INC., Reading, Penn.

"Here's what Happened in our Plant"

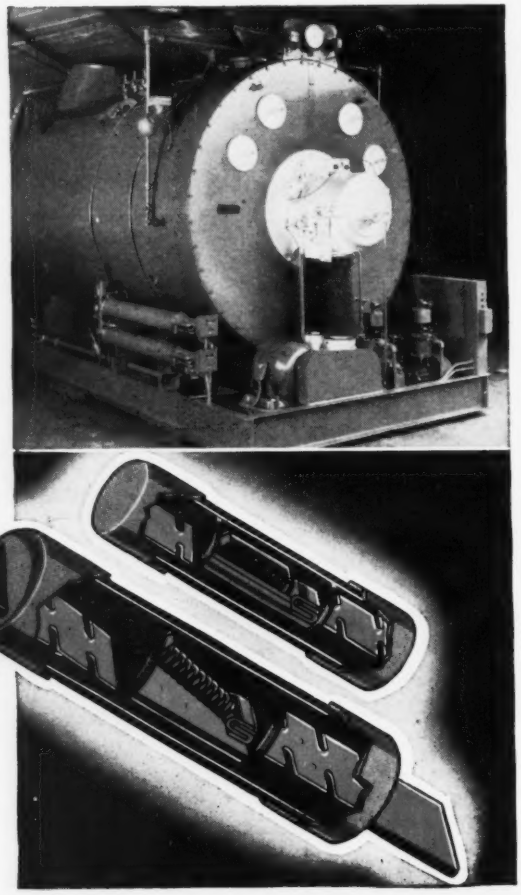
Back in January of 1951 we had a motor on a pump that was supposed to draw a maximum load of about 8 amperes, yet it began blowing FUSETRON fuses of motor protection size.

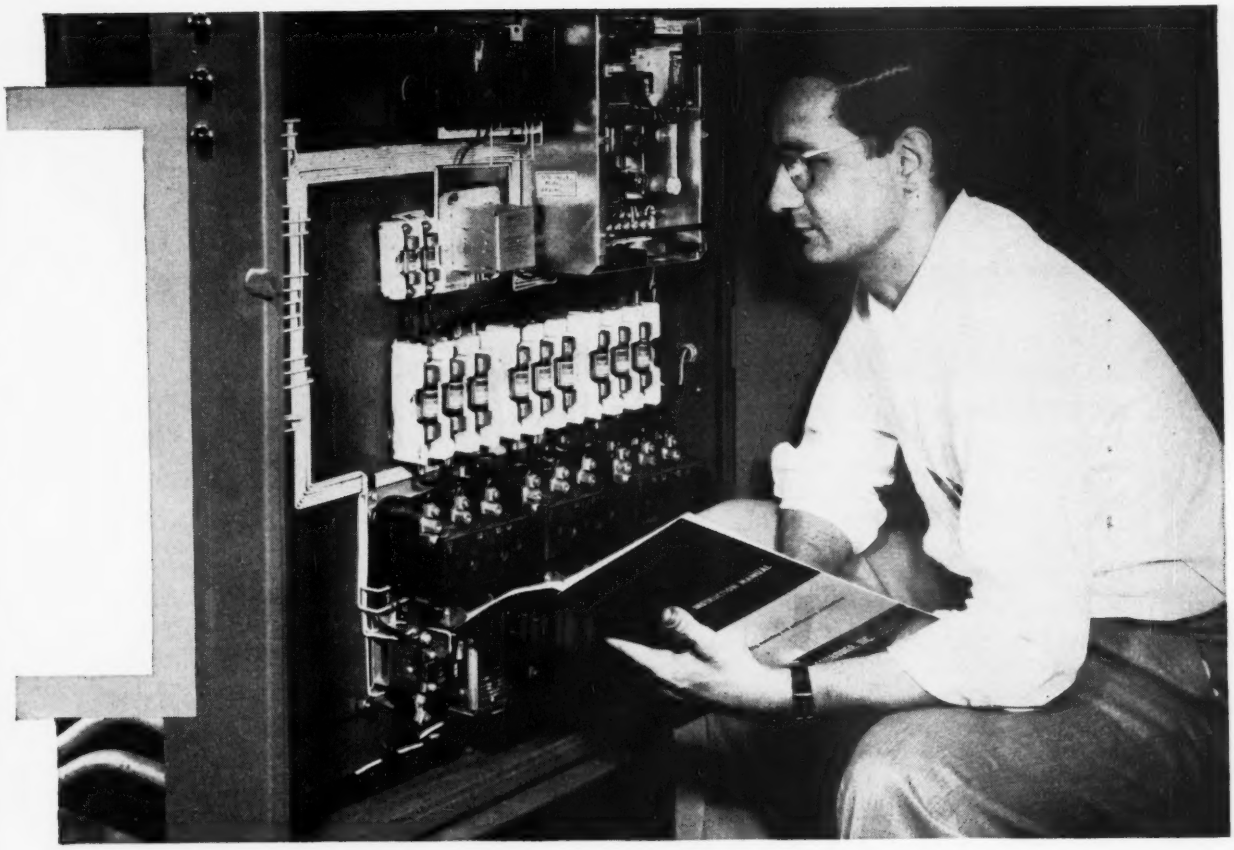
"We were inclined to believe something was wrong with the fuses — but after checking with an ammeter we found that an automatic relief by-pass was sticking and causing the motor to draw about 12 amperes.

"If the Fusetron fuses had not opened, the motor would undoubtedly have burned out.

"Now on all our Powermaster Steam Generator Units we use Fusetron Fuses to protect the motors on the fuel pump, the boiler feedwater makeup pump, and the air compressor."

Franklin Van Reed
Production Engineering Supervisor
ORR & SEMBOWER, INC.,
Reading, Pennsylvania





You, too, can profit by the

10 POINT PROTECTION of Fusetron Dual-Element Fuses . . .

1 Protect against short-circuits.*
2 Protect against needless blows caused by harmless overloads.
3 Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5 Protect motors against burnout from overloading.
6 Protect motors against burnout due to single phasing.
7 Give DOUBLE burnout protection to large motors — without extra cost.
8 Make protection of small motors simple and inexpensive.
9 Protect against waste of space and money—permit use of proper size switches and panels.
10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

THE MONEY YOU SAVE . . . by preventing one **needless** shutdown, one **lost** motor, one **destroyed** switch or panel or one **burned out** solenoid . . . MAY MORE THAN PAY FOR the replacement of all your ordinary fuses with Fusetron dual-element Fuses.

THIS COUPON WILL BRING YOU complete information about the All-Purpose Protection of FUSETRON Dual-Element FUSES

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. (Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name_____

Title_____

Company _____

Address _____

City & Zone_____ State____ EW 2-53

News about

B. F. Goodrich Chemical *raw materials*

CHECK THIS TABLE

See why GEON RESIN 404 provides improved jacketing and insulation

PROPERTIES OF IMPORTANCE TO THE ELECTRICAL FIELD

ELECTRICAL PROPERTIES	
Insulation Resistance megohms—1000 ft., @ 50°C—½" wall	20,000—35,000
Dielectric Strength (v/mil) @ 25°C in air	
¼" wall	1,200—1,300
½" wall	800—1,000
Power Factor @ 1000 cps @ 25°C	.015—.02
Dielectric Constant @ 1000 cps @ 25°C	3.0—3.2
Loss Factor @ 1000 cps @ 25°C	.045—.064
PHYSICAL PROPERTIES OF WIRE INSULATION	
Tensile Strength #/sq. in.	6,500—8,500
Elongation—%	15—25*
Hardness—Durometer	82D
Specific Gravity	1.35—1.45
Low Temp. Flex 2 hrs./°F (6 turns around .3 mandrel) passes	−70°
Heat Stock—1 hr./120°C	OK
Air Oven Aging—7 days @ 100°C—% Retention of Elongation	100
Cutting Resistance @ 50°C (lbs. thru .032" wall) .025" conductor	>66
Cutting Resistance @ 70°C	47.5
Compression Strength @ 25°C (lbs./2 in. length)	8500
Deformation (½" wall, 1,000 gm. wt. on ⅜" ft.) 1 hr. @ 120°C	25%
Abrasion Resistance** Taber Abrader (60 D2R)	
5000 rev—weight loss	.085gm.
volume loss	.060cc

* Jaw separation—1 inch/min.
** Run on tensile sheets

THIS table tells you why rigid insulation and jacketing based on Geon Resin 404 provides an entirely new approach to the use of vinyls on wire and cable. Geon Resin 404 has electrical properties even superior to those obtained with normal plasticized polyvinyl chlorides . . . because it is *especially designed* for use without plasticizer.

Possessing all the physical and electrical properties of straight polyvinyl chloride, Geon Resin 404 can be processed without plasticizer addition on standard equipment.

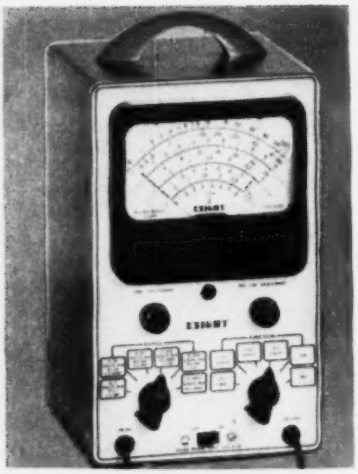
Consult your wire and cable supplier

For comparison, check the properties of a standard vinyl compound with those of Geon 404 listed in the table. Then consult your wire and cable supplier about your insulation and jacketing requirements. You'll find Geon Resin 404 provides advantages heretofore unattainable. For further information, write for Bulletin G-6. Please address Dept. GJ-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

IMPORTANT NOTE! Geon compounds have the Underwriters' Laboratories approval for use as Type T insulation on aluminum wire.

GEON RESINS • GOOD-RITE PLASTICIZERS...the ideal team to make products easier, better and more saleable

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers. HARMON organic colors



ranges. It also has 6 ranges for ac rms volts, 6 for ohms and dc volts. Frequency response is up to 2.5 Mc.

Special probes are available for extending the dc range to 30,000 v and for extending the ac range to read RF to 200 Mc.

Allied Radio Corp, Chicago 7, Ill.

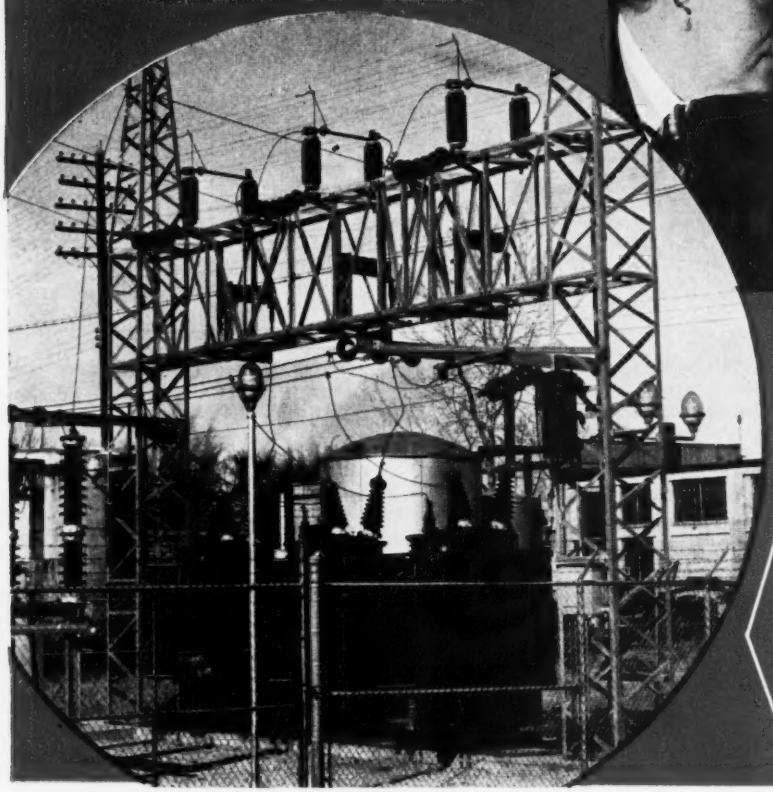
Pneumatic Transmitter

For measuring and transmitting readings of temperature, pressure, vacuum, and liquid level to recording, indicating, and controlling receivers. Transmission is by means of air pressures of between 3 and 15 psi.

Series 650 uses a simple transmitting mechanism with only one pivot and no flextures. Friction and lost motion are

"TRANSFORMERS?

We've had very satisfactory experience with Central!"



A Type for Every Need

Transformers in sizes from 2 KVA to 10,000 KVA, up to 115 KV primary class. Photo at left shows a bank of 667 KVA Power Transformers, 69 KV Primary to 2400/4160Y Secondary.

7 Reasons for Superiority of Central Transformers:

- *Skilled, Conscientious Workmanship*
- *Tried-and-Proven Dependability*
- *Trouble-Free Performance*
- *Minimum Maintenance*
- *Long Life*
- *Reputation — Thousands in Use*
- *Prompt, Efficient Service*

CTC Central Transformer Corp.

FORMERLY LARKIN LECTRO PRODUCTS CORPORATION

PINE BLUFF, ARKANSAS

SALES OFFICES IN PRINCIPAL CITIES

beauty of
simplicity....
GUTH
PEER-LITE
MODERN AS TOMORROW IN DESIGN AND LIGHTING EFFECT
PEER-LITE fixtures offer great flexibility. Pattern Planning is unlimited—you can form T, H, □, +, I... any design you wish.
PEER-LITE has 20% uplight. Top plates for 100% downlight can be provided. Luminous side panels add beauty and comfort.
For 2, 3 or 4 lamps—4' or 8' long.
PEER-LITE with GrateLite—a truly beautiful team
SEE HOW VERSATILE PEER-LITE IS:
Any louver or glass diffuser you may wish can be supplied: GrateLite*, eggcrate, Albalite, Flutex, Optilux, also prismatic lens bottoms.
*U. S. & Can. Pats. Pend. Trademark Registered
LEADERS IN LIGHTING
Guth
..... SINCE 1902
EGGCRATE LOUVER
ALBALITE GLASS
May we send you our folder 900-H?
THE EDWIN F. GUTH CO. • ST. LOUIS 3, MISSOURI

thereby eliminated, it is claimed. The transmitter is sensitive to changes as little as 0.03% of range, including reversal. High-speed transmission results from the use of a pneumatic relay, having an output capacity of 3.0 scfm.

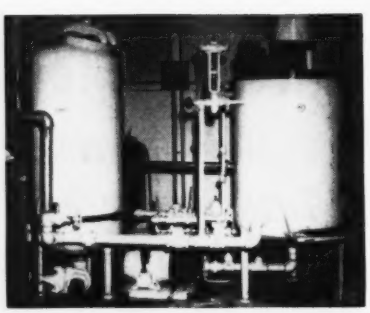
The transmitter weighs 7½ lb, is weatherproof, can be installed in any location and will operate in any position.

The Bristol Co, Waterbury 20, Conn.

Comparison Bridge

Type 1604-A, with a basic accuracy of 0.1%, can be used for comparison of resistors, capacitors and inductors over the wide impedance range of about 2 to 20 ohms. The bridge is completely self-contained with a cathode-ray visual detector and an oscillator operating at either 1 Kc or 5 Kc. Operation is from the ac line. The point where the bridge is grounded can be switched so that measurements can be made with the unknown grounded or ungrounded.

General Radio Co, Cambridge 39, Mass.



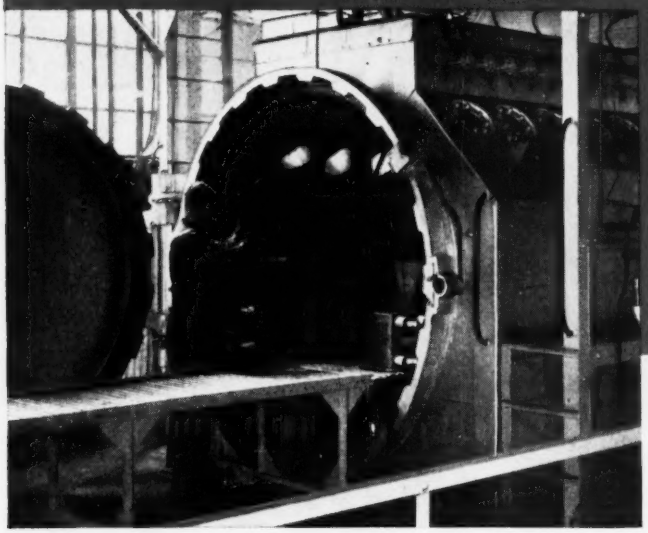
Pressure Filter

To filter oils, chemicals, the recovery of wastes and treatment of water. It eliminates all cloth, papers,

(*Continued on page* 186)

Get all 4 advantages

ALLIS-CHALMERS INSTRUMENT TRANSFORMERS



1. *Insulation completely protected against air and moisture*
2. *No insulating liquids to maintain*
3. *No leakage — simplified storage and handling*
4. *High dielectric strength*

VACUUM-PRESSURE PROCESS ADDS YEARS TO INSTRUMENT TRANSFORMER LIFE. In the chamber shown above, Allis-Chalmers vacuum-pressure compound-filling process makes the core and coil assembly and its insulation a solid, compact unit within its case. As a result, insulation is completely protected against outside air and moisture. High dielectric strength is assured. And transformer maintenance is greatly reduced.

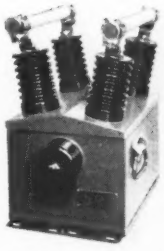
HERE'S HOW IT'S DONE

Two steps do the job. First, a combination of high vacuum and heat drive moisture from the core and coil assembly. Then, while the vacuum is maintained, the case is filled with hot compound which is chemically stable and free of absorbed gases and impurities. This draws hot compound into the innermost parts of the assembly, preventing local ionization and extending normal insulation life.

ELIMINATES PERIODIC TESTING

Since compound-filling eliminates insulating liquids, periodic inspections can be reduced. There is no need for filtering or testing liquids. Storage and handling are simplified because there is nothing to leak out. It is easy to see why you save money and trouble. Why not call your nearby A-C district office today and get more information. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Outdoor current transformers, Type KO, rated up to 15 kv and 1800 amp.



Indoor potential transformers, Type PD, rated up to 14,400 volts, 200 va, fused or unfused.

Outdoor potential transformers, Type PWD, rated up to 15 kv, 200 va.

A-3978

ALLIS-CHALMERS

Since the introduction of fluorescent lighting...

greatest STEP UPWARD in industrial SEEING COMFORT

...new BENJAMIN "Task Master"

Shatters precedent with a completely new concept of lighting unit design!

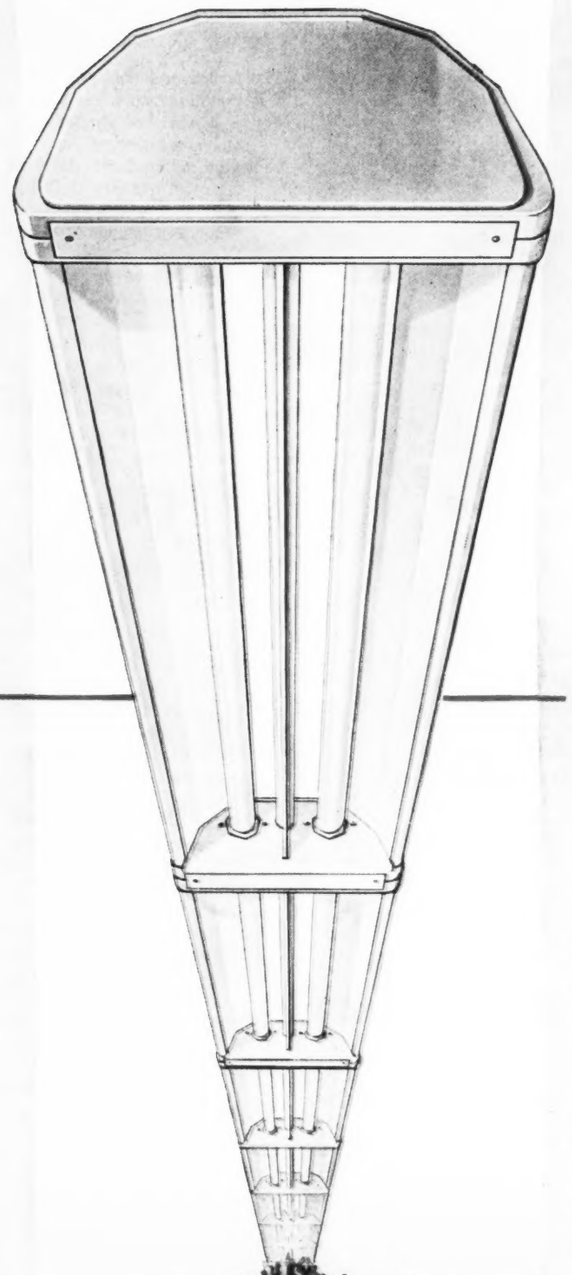
Masters the brightness ratio problem by directing approx. ¼ of light upward!

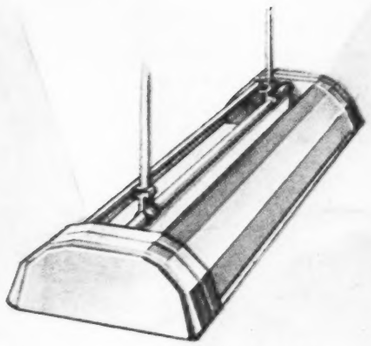
Doubles... even triples... present standards for industrial seeing comfort!

Introduces new methods of installation and maintenance!

Yes, the new Benjamin "Task Master" is the greatest step UPWARD in industrial fluorescent lighting history. It's a step UPWARD to high lighting levels without the discomfort which can often accompany them... a step UPWARD to complete freedom from annoying ceiling contrast that may cause excessive brightness ratios. It's a step UPWARD to greater seeing comfort in America's work places! Moreover—"Task Master" represents a great step UPWARD in high-speed installation and trouble-free maintenance, as shown above. Get full details about this greatest step UPWARD in industrial seeing comfort... send for FREE "TASK MASTER" Data Bulletin, containing complete specifications. Write:

Benjamin Electric Mfg. Co., Dept. K, Des Plaines, Ill.





3 ways to mount: chain, conduit and sliding hanger suspension (illustrated).

UPWARD ILLUMINATION COMPONENT directs approximately ¼ of light towards the ceiling. In addition to providing more generous **UPWARD** flow of light, this unique construction reduces maintenance expense as it practically eliminates horizontal areas where dust and dirt can collect.

DETACHABLE REFLECTORS are hinged to facilitate easier, more thorough cleaning right on the fixture; or they may be quickly unhinged and replaced with reflectors which were previously cleaned at a bench. 2 simple spring-type clips lock or release each reflector . . . no tools needed.

PRE-WIRED . . NO WIRE SPLICING . . All Connections made to Terminal block. No need to run line wire through fixture. Furnished with branch circuit wiring already run through a combination spine support and lamp shield. (Shielding angle is 35°) Just connect line wires to terminals (see picture A above). For continuous line installations, simply connect "jumper" wires to opposite terminal blocks (see picture B).

BALLAST AND TERMINAL BLOCK are strategically located in easily-accessible end sections . . . out of the way for more streamlined appearance.

Of course, **EXCLUSIVE BENJAMIN "SPRINGLOX" LAMPHOLDERS** are standard equipment. They are acknowledged as embodying the most advanced lampholder features. Such as: rugged, all-metal construction and unique, patented spring design for "quick-in, quick-out" lamp maintenance.

THE Big 3 IN WESTERN POLES

• produced
• treated
• sold by...

J. Neils Lumber Company

Look to the West for transmission and telephone poles... To western Montana, where much of America's finest virgin timber is located...To the J. Neils Lumber Company plant at Libby.

Long a quality manufacturer of forest products (since 1895) J. Neils is a major producer of power and telephone poles.

At Libby, Montana, in the heart of a great forest empire, J. Neils manufactures and treats the poles that come from magnificent stands of Western Larch, Lodgepole Pine and Douglas Fir. This modern pole treating plant measures up to the highest quality standards in men, materials, equipment and methods.

An illustrated folder on J. Neils treated poles, and information regarding their application to your requirements, will be furnished gladly on request.

J N **J. Neils Lumber Company**

Pole Division: LIBBY, MONTANA

Pressure Filter

(*Continued from page* 182)

screens and pads, yet insures controlled quality filtration and higher flow rates.

A series of synthetic, rigid porous stone membranes, upon which the filter aid coating is deposited, provide a perfect retaining surface for the formation of a controlled clarity filtration, and allow a fast backwash. Diatomaceous silica is used for the filter.

The filtration cycle is lengthened because a new filtering surface, constantly increasing in size, is presented to the liquid being filtered, it is claimed. Cleaning and sterilization of the filter can be accomplished without opening the chamber.

Ogden Filter Co, Los Angeles 29, Calif.

MORE NEW PRODUCTS
about which you should know

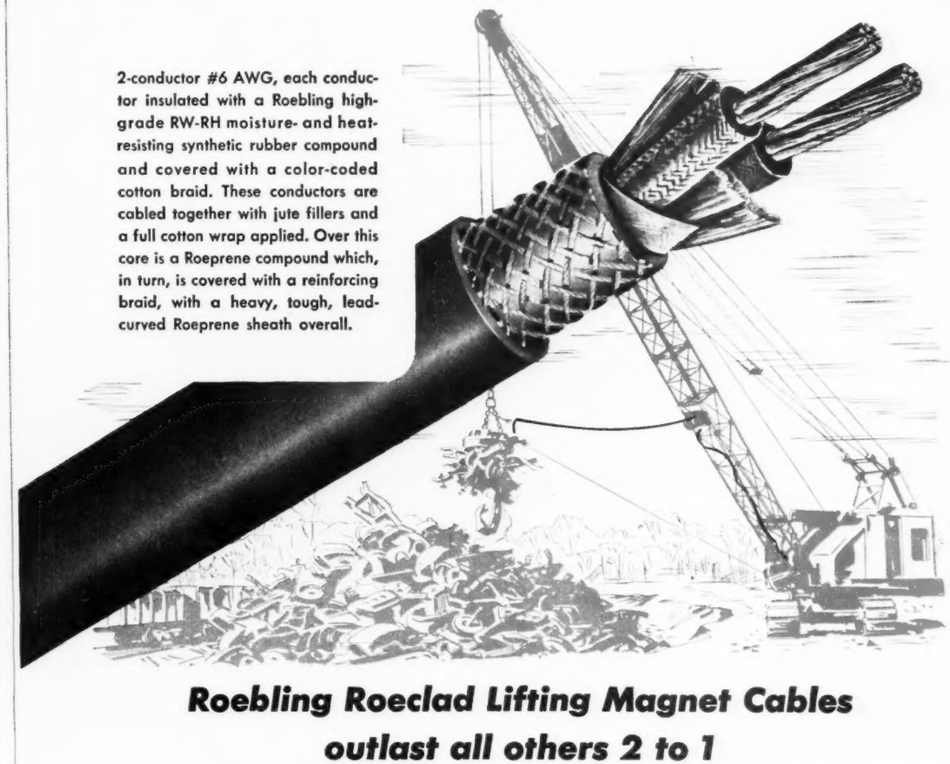
Industrial Products Co, Philadelphia 33, Pa., has a flashing **bulletin board,** operating on a 40-w lamp and flashes approximately 15 times a minute. Claimed to assure messages of being seen and read . . . Wall Manufacturing Co, Grove City, Pa., announces a series of **soldering irons** with a thermostatic action to control heat so that fusing and tip-burning are eliminated.

Brush Nail Expansion Bolt Co, Greenwich, Conn, has added to the line of **screw locking inserts** that will accept screws from 4-40 to ¼-20. They are made of aluminum and have a knurled band on its grip area . . . The Daven Co, Newark, N. J., has a series of **resistors,** featuring shock-resistant construction, and provides complete protection from corrosion, fungus and other harmful affects of humidity and temperature.

Minneapolis-Honeywell Regulator Co, Philadelphia 44, Pa, has extended the **integrator** use so that it can be used on 40-cps and 66⅔-cps power sources . . . Aircraft-Marine Products, Inc, Harrisburg, Pa, announces a **five-purpose tool** for cutting, stripping and crimping wire in sizes No. 22 to No. 10. It can be used for shearing bolts up to No. 10-24.

ROECLAD PORTABLE POWER CABLES

2-conductor #6 AWG, each conductor insulated with a Roebling high-grade RW-RH moisture- and heat-resisting synthetic rubber compound and covered with a color-coded cotton braid. These conductors are cabled together with jute fillers and a full cotton wrap applied. Over this core is a Roeprene compound which, in turn, is covered with a reinforcing braid, with a heavy, tough, lead-curved Roeprene sheath overall.



Roebling Roeclad Lifting Magnet Cables outlast all others 2 to 1

Roebling Roeclad Lifting Magnet Cable is engineered and produced to withstand rough treatment and to give long service life. The design of this cable is based on field experience of more than 30 years.

Exhaustive tests performed in Roebling laboratories to prove the superiority of Roeclad Lifting Magnet Cables included fatigue and impact tests of representative samples.

In a fatigue test, cable samples after being subjected to more than 2,000,000 reversals—half at room temperature and half at 0°F.—showed no damage to either of the two conductors.

In impact tests, it required over 3000 blows of a 20-lb. weight dropped 5½ inches, 25 times per minute, to cause failure of a two-conductor #8 AWG Roeclad Lifting Magnet Cable.

And a report from an engineering company which has a large number of machines equipped with magnets is typical of the entire field... that Roeclad Lifting Magnet Cable out-performs competitive cables by at least 2 to 1.

Through unending research and development, Roebling's complete electrical line is constantly being improved. You can always buy Roebling with assurance of top efficiency and economy. John A. Roebling's Sons Corporation, Trenton 2, N. J.

Subsidiary of The Colorado Fuel and Iron Corporation

ROEBLING

ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST & 5 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST • DETROIT, 915 FISHER BLDG • HOUSTON, 6216 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST & 120 S. HEWITT ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1920 E. 2ND ST • PHILADELPHIA, 230 VINE ST • PITTSBURGH, 1301 CLARK BLDG • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 321 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY

CF&I

NO. 9 IN A SERIES

THE CHIEF ENGINEER OF A UTILITY RECENTLY ASKED—

"If I recommend placing this first order with PINCO, what assurance can you give me that deliveries will be made as promised?"

STRINGS OF SUSPENSION INSULATORS are assembled and packed in wire bound crates of our own design. The string of insulators is under tension within the crate to prevent damage in transit. Cross braced for rigidity, these space-saving crates are easy to handle, easy to stack in the warehouse or on the truck. Style numbers and quantities are clearly marked on each crate.

HERE'S ANOTHER PACKAGING INNOVATION DEVELOPED BY PINCO . . . carton packing of distribution insulators and guy strains. This method of packing reduces shipping, storing and handling costs. Here again, each carton is plainly marked with style number and quantity.

HERE'S OUR ANSWER:

We understand why you are concerned. The significance of your question is borne out in a recent utility survey of construction delay factors which showed that "failure of suppliers to meet equipment delivery promises was *number one* on the list."

Look at the Pinco record. Check with our customers. They will tell you as they have us that our delivery promises are "the most reliable in the industry." Careful scheduling has made this fine record possible. And when we accept your order, we feel that we are part of your construction department. Our responsibility is to see that our material is "right on the job" . . . on time . . . when you need it!

PINCO MAKES SURE THAT INSULATORS ARRIVE *SAFELY* AS WELL AS ON TIME . . .

Science plays an important role in packing Pinco Insulators as well as in making them. Here at Pinco, in this final, important plant operation, the packing of insulators is a carefully developed and executed process . . . another example of Pinco planning which insures *safe* delivery and facilitates quick, easy, efficient handling of insulators "*right on the job.*"

If insulator deliveries have been the "bottle neck" in your construction programs, then we invite you to put your problem up to Pinco. We will welcome the opportunity to prove that the Pinco slogan "RIGHT ON THE JOB" is a real symbol of service in action! A letter, telegram or phone call will give you the answer.

The Porcelain Insulator Corporation
LIMA, NEW YORK

Sales Agents:
JOSLYN MFG. & SUPPLY CO.
Offices in Principal Cities

LETTERS TO THE EDITOR

British Exhibition

To the Editor:

I have received one or two applications for details of the Electrical Engineers Exhibition we engineers have decided to run at Earls Court, London.

My Council have asked me to extend an invitation to your fellow engineers if they are able to visit the show.

P. A. Thorogood, MASEE
Hon. Exhibition Secretary
Ass'n Supervising Electrical Engineers
Edgware, Middlesex, England

• This second exhibition will be held March 25-28 at Earls Court, London SW5. Featuring illumination and commercial cookers, the displays will cover all matters of interest to the brotherhood.

The Supervisor's Role

To the Editor:

I read with great interest the section in the Nov. 17 issue . . . "The Supervisor's Role." As we are forming a new organization I am very much interested in obtaining reprints . . .

J. G. Koopman, Electric Energy, Inc, Joppa, Ill.

You are to be congratulated on the excellent work you did in connection with the industrial relations articles in the Nov. 17 issue. It is our belief that the information contained can be continuously used by supervisors at all levels.

A. L. Colligan, Central Hudson Gas & Electric Corp, Poughkeepsie, N. Y.

Our organization certainly enjoyed . . . "The Supervisor's Role." We are putting this article on our required reading list for all supervisory personnel.

Charles V. Stimson, Jr, Southwestern Public Service Co, Plainview, Texas.

. . . it is our opinion that this material is worthy of a wider circulation.

G. A. Casey, Hydro Electric Power Commission, London, Ontario

• Words like the above are just what editors need to spur them on to the bigger and better jobs they hope to do.

Incandescent for Hospitals

To the Editor:

In an article "Radio Isotrope Facilities for the General Hospital," Architectural Record, Dec. 1953, it was stated that incandescent lamps are preferable to fluorescent in this area of a hospital.

Knowing Dr. Ernest H. Wakefield, director of the Radiation Counter Laboratories, Skokie, Ill., I referred the statement to him as an authority. He says:

"Incandescent is better for three reasons.

"One—Its spectrum being more toward the red than the fluorescent lamps, its photons have less energy to react on the cathode of a sensing element, such as a Geiger counter, thus rendering less likely any spurious counts due to photo-electron action.

"Two—The fluorescent lamp and associated circuitry reflect back into the line a high frequency ripple which can cause spurious pulses to be recorded, especially in a proportional counter, because of the electronic amplification. Such a circuit picks up one-millivolt impulses.

"Three—Electronic radiation is more prevalent from an arc lamp."

All of which is probably agreed upon by engineers and physicists, but the closing phrase of Dr. Wakefield's comment is clear to all laymen: "There's a lot of life in the old girl (tungsten filament) yet."

Fred W. Wakefield
Sales Representative
F. W. Wakefield Brass Co
Vermilion, Ohio

The Name Is IMSA

To the Editor:

In your issue of Jan. 12 giving such a splendid tribute to our wonderful friend and member A. L. Pierce of Wallingford, Conn., you state he is a member, among other organizations, of the International Association of Municipal Electricians. This was the name of our organization many years ago. It is now, and has been for many years, the International Municipal Signal Association.

Irvin Shulsinger
Secretary, ISMA
New York, N. Y.

Cover Safety

To the Editor:

Reference is made to the front cover of Dec. 15 issue.

The artist depicted a peaceful background. However, the truck and men in the foreground are amiss in many respects.

No driver would venture on snow covered country roads without tire chains.

The truck step at the rear should not be used to transport employees due to the danger of bouncing them off.

In the event these linemen travel any distance to the next emergency in the open exposed condition shown, they would be unable to render proper service, being too uncomfortably cold.

Peter Warmenhoven
DA Civilian, R&U Branch
Chief, Engr Sec, NBG Dist
U. S. Army

Not Generosity

To the Editor:

Enclosed is a copy of a letter which I am sending to an electrical contractor who wrote me from Allentown, Pa, which proves to me that the article in the December 29 issue of the Electrical World is getting around, and it apparently meets with the favor of the contractors.

It was very generous of McGraw-Hill to present this contractor article to the electrical industry, and I am sure that the National Electrical Contractors Association and its more than three thousand members will appreciate Electrical World giving us this space to tell our story.

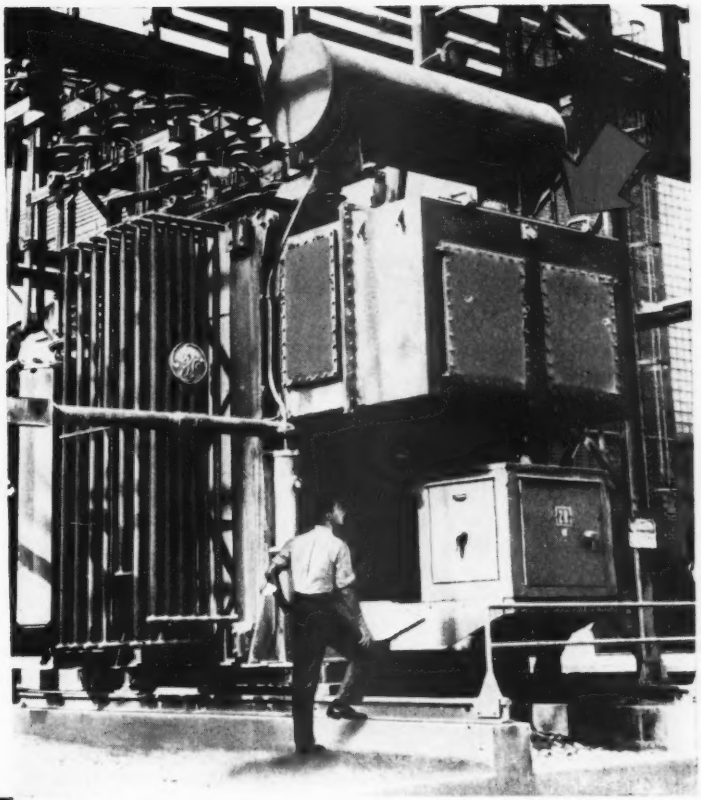
Edward J. White
President

Edward J. White Co
Newark 4, N. J.

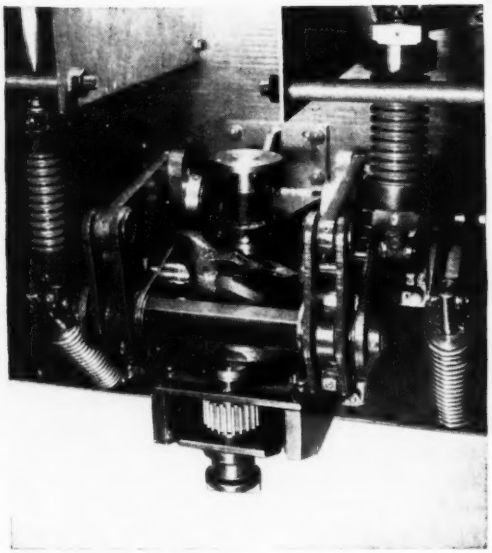
• The exchange of letters mentioned by Mr. White was started by a note from Alvin Hill Stryker of the H. N. Crowder Jr Co, Allentown, complimenting Mr. White on the article "Contractors Discover the Values of Selling." And we were not motivated by generosity in printing Mr. White's article. We printed it because we thought industry should hear what he had to say.

No appreciable mechanical wear after 1,017,706 tap changes

G-E load-ratio-control averages 800 tap changes a day at Alcoa plant



G-E LOAD-RATIO-CONTROL TRANSFORMER rated 40,000 kva (output) 13.8 kv, installed at Alcoa's Vancouver plant, provides ±5% voltage regulation.



MILLIONS OF TROUBLE-FREE OPERATIONS are built into this hardened steel cam assembly—typical of the mechanical strength of G-E load-ratio-control. Each new LRC design must pass mechanical-life tests of several million operations before it can be approved for production.

The load-ratio-control equipment on this transformer really has to "take it." Installed on January 16, 1946, it has already completed more than a million tap changes under load! At its last inspection on January 17, 1951, Alcoa found the LRC mechanism in excellent working order. None of the mechanical parts—bearings, pins, cam rollers or cam surfaces—showed appreciable wear.

Without a rugged mechanical system, the toughest electrical parts would be worthless. That's why every new LRC design must pass mechanical-life tests equal to at least 30 or 40 years of ordinary service!

Requires less routine maintenance, too!

With G-E load-ratio-control, you don't do any *unnecessary* service work. The instruction book which accompanies each unit tells how many operations you can expect the LRC equipment to perform before you have to replace contact tips and clean insulation.

This means you can eliminate unnecessary inspections. Simply refer to the instruction book and read the operations counter to schedule maintenance only when it is needed!

Over 39,000,000 installed kva have proved that General Electric LRC is as reliable as the core and coils themselves.

General Electric Company, Schenectady 5, New York.

401-22

GENERAL ELECTRIC

Sometimes

"Who Says So?"

is Mighty Important!

PLANNING and engineering fire protection —especially for those key hazards where fire can hit like lightning and with crippling effect—is a job for experienced specialists only. Knowing "who says so" and his qualifications may save you from huge loss.

Fire protection by low pressure carbon dioxide is no exception. And here CARDOX' experience is literally years ahead!

With thousands of installations, *plus* years of creative research concentrated by war and high priority projects—CARDOX' knowledge in the engineering and manufacture of low pressure carbon dioxide fire extinguishing systems is unparalleled. Protecting many of the world's toughest hazards, CARDOX Systems* have saved industry from uncountable losses in dollars and production.

A survey of your hazards by CARDOX puts this experience at your service. It can be of great value to you—and it costs you nothing. Why not write for a CARDOX *survey* now?

*Covered by Patents, Issued and Pending.

CARDOX

ORIGINATOR OF LOW PRESSURE CO_2 FIRE EXTINGUISHING SYSTEMS

CARDOX CORPORATION • BELL BUILDING • CHICAGO 1, ILLINOIS

Offices in Principal Cities

WHAT THEY'RE SAYING

At Industry's Meetings

Research for National Defense

DR. ALAN T. WATERMAN, director, National Science Foundation, before the Southwestern I.R.E. Conference, San Antonio, Texas

It is the universities themselves which have the primary responsibility for preserving a sound balance between the basic research and teaching that are their traditional functions and the applied research and development that they undertake at the behest of others. I believe that the interests of national defense can best be served if the Federal Government and the universities will unite in a critical examination of the research and development that the universities are asked to undertake on behalf of the Government.

Let them make a special effort to see that the universities undertake only those kinds of problems that cannot be solved in Government laboratories or in the industrial laboratories. Let us all look for new and more effective ways of strengthening the financial structure of our higher educational system so that the colleges and universities may not be tempted to undertake work that should be done elsewhere.

Mechanization and National Economy

ARTHUR F. VINSON, asst manager of manufacturing, General Electric Co, at the annual meeting of the Cutting Tool Manufacturers Assn, at Detroit

Progress toward automatic factories and mechanization is the logical way to support the nation's increased production goals. Complete mechanization, although a necessity for our economy, is a long way off and must be a gradual process rather than jumping headlong into it. The electrical industry alone expects to build as much equipment in the next ten years as it has in its entire 75 year history. To achieve this rate of production would require twice the number of people now employed. However, economists expect the labor force to increase only 11 percent in the next decade. The answer is to increase, through mechanization, the production capabilities of existing manpower and manufacturing facilities. Those

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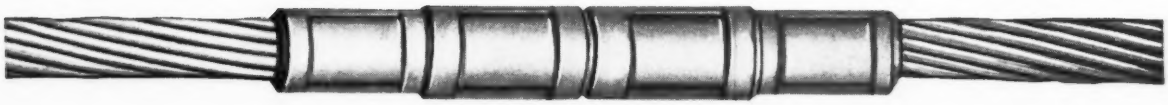
SPLICING SLEEVES

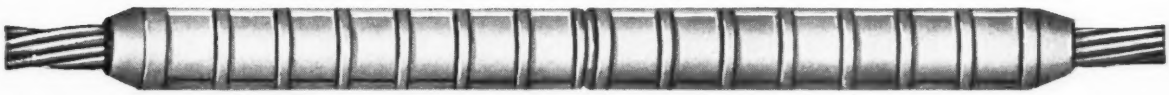
FOR LARGE CONDUCTORS AND HIGH-STRENGTH STRANDS

**Light in weight—Holds full strength of conductor—
High in conductivity**



Completed NICOPRESS Splice on 4/0 Copper Conductor

**Completed NICOPRESS Splice on 3/8" Extra High Strength
Copperweld Strand**



**Completed NICOPRESS Splice on 3/8" Extra High Strength
Galvanized Steel Strand**

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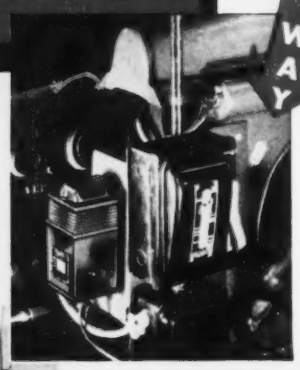
Canadian Affiliate: H. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA • Export Distributors: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

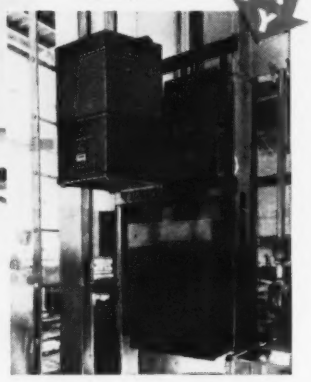
USE JEFFERSON AIR-COOLED POWER CIRCUIT TRANSFORMERS

Jefferson Transformer mounted directly on machine tool stepping down 230 volt main circuit to 115 volts for machine lights and controls.



Group of four Jefferson Transformers stepping down 460 volt main circuit to 115 volts for small tool operations.

Here a Jefferson Transformer steps down 575 volt circuit to 115 volts for lighting circuits.



STOCK SIZES

50 V.A. to 15,000 V.A. 460/230 Volt Pri.—230/115 Volt Sec., 575 Volt Pri.—230/115 Volt Sec. *Bulletin 501-15 with full information sent on request.*

Distribute Economical High Voltage...460-575
Provide Low Voltage Only Where Needed...115-230

High voltage power distribution provides greater volt-ampere capacity with no increase in copper wire and steel conduit sizes. You save materials, wiring costs, maintenance costs, installation time and eliminate duplicate wiring.

Jefferson Power Circuit Transformers can be mounted directly on or adjacent to machinery or wherever low voltage is required. Air-Cooled "Dry Type" construction makes Jefferson Transformers exceptionally compact and easy to install. Ample wiring compartments and *both* ½" and ¾" knockouts are provided for rigid or flexible conduit connections.

Approved by Underwriters' Laboratories, Inc.

JEFFERSON ELECTRIC COMPANY
Bellwood, Illinois

Jefferson Transformers

who refuse to progress, those who cling to the old methods too long, will fall by the wayside. Those who progressively mechanize will contribute the most toward the support of our expanding economy.

Planning Control Devices

HENRY F. DEVER, president, Brown Instruments Div, Minneapolis-Honeywell Regulator Co, at 8th annual instrumentation conference at Texas A & M College

Management that has become conditioned to traditional ratios of spending must now recognize that system engineering justifies its cost. In almost any mass production even minor improvements in efficiency are measurable in anywhere from thousands to millions of dollars yearly. It is imperative that American industry develop the full potential of automatic control. Our present labor force will be hard pressed to meet the demand for the things people want. Automatic controls and industrial instruments can be utilized to ease this productive burden better if they are engineered into each new production facility at the outset rather than applied after a process has been set up.

Small Business

E. F. LEATHEM, assistant to the president, Raytheon Mfg Co, in a report to the Air Force Small Business Sub-Contracting Program Committee

Small business as far as national defense is concerned is small in name only. A belief has been prevalent that the bulk of orders for the government defense program is going to large companies and that small business—firms employing 500 or less—are being left out in the cold. Results of a recent survey in New England, however, indicate that small business is doing all right for itself. Normal purchasing practices which generally are followed by most large concerns require that we place as many orders as possible with small business, not only because it is in line with government requirements but also because we have found it is good business to do so. Improved liaison, better quality and quantity control, closer personal attention to our requirements, and competitive prices are among the advantages resulting. Every effort has been made to lean toward small business if, in our estimation, they are as capable as large organizations to meet our requirements.

Series AJ Helipot models are only ¾" in diameter and 1⅜" long; weight 1.0 oz. Ten-turn 18" slide wire gives adjustment accuracy of 1/3000 in a 100-ohm unit—1/6500 in a 50,000-ohm unit.

Helipot achieves "HIGHEST PRECISION" with DRIVER-HARRIS RESISTANCE WIRE

Cutaway view of Model A 10-turn Helipot precision helical potentiometer. Resistance element 45" long is contained in case 2" x 1-13/16" diameter. On element are wound 3000 to 9800 turns of resistance wire, depending on total resistance value required. Adjustment accuracy is 12 to 14 times that of conventional single-turn potentiometer of equal diameter.

To win consumer preference and assure customer satisfaction, Helipot Corporation is guided by a basic policy that has proved as effective as it is simple. It is: (1) to produce components of the highest precision, and (2) to realize the economies inherent in mass production.

By following these objectives, Helipot has become the world's largest maker of precision potentiometers, producing the widest selection of single-turn and multi-turn units available anywhere.

States Helipot: "Our policy of mass producing the highest precision potentiometers practicable, in order to deliver top quality at moderate cost, is reflected in the fact that standard linearity accuracy of all our stock models, selling competitively, is held to ±0.5%. Our reliance on Driver-Harris alloys such as Nichrome V, Advance, and Karma to provide resistance windings for many of our products constitutes a strong endorsement of Driver-Harris skills and reliability."

Driver-Harris takes particular pride in having played so important a role in the Helipot story, and is fully conscious of the responsibility the confidence of this famous manufacturer imposes.

Nichrome*, Advance*, and Karma* are at your service, too; as are more than 80 other alloys developed exclusively by Driver-Harris for application in the electrical and electronic fields. We feel confident that, like Helipot, you will realize outstanding advantages by putting one or more of them to work for you. Let us have your specifications. We'll be glad to make recommendations based on your specific requirements.

*T.M. Reg. U.S. Pat. Off.

Sole producers of Nichrome, Advance, and Karma

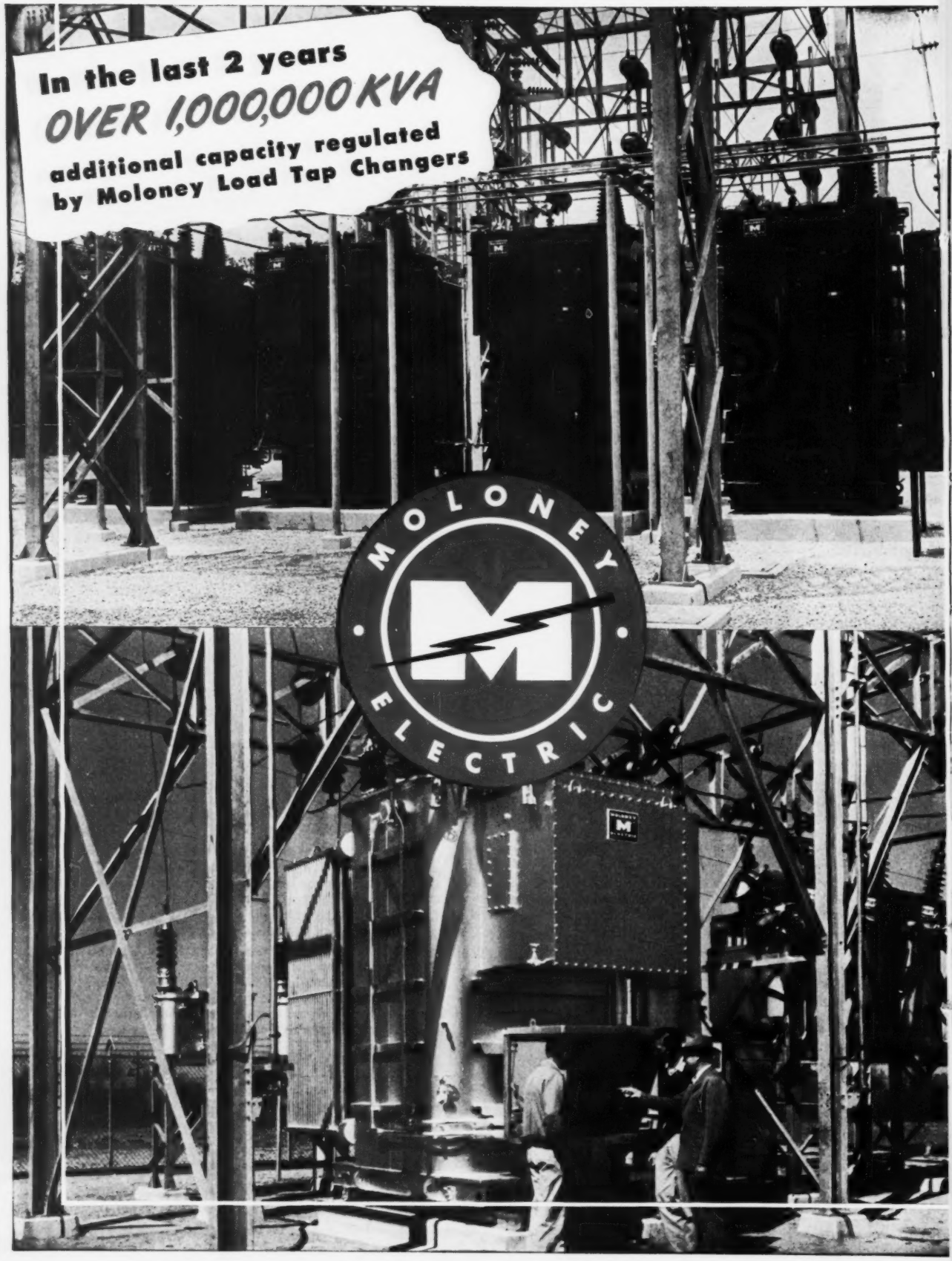
Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario.

MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

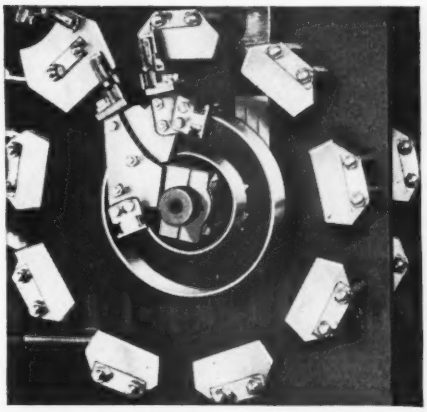

In the last 2 years
OVER 1,000,000 KVA
additional capacity regulated
by Moloney Load Tap Changers
MOLONEY
ELECTRIC

MOLONEY LOAD TAP CHANGERS

Offer these advantages for feeder voltage regulators, regulating transformers and load ratio control transformers

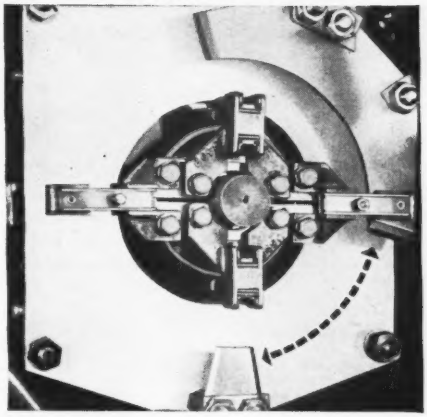
ELECTRICALLY

No arcing duty is imposed upon any of the tap selector switch contacts, avoiding the necessity for replacement due to burning or scoring. A separate switch is used for breaking load current, and a reactor in parallel with this switch during each opening and closing keeps arcing here to a minimum. Virtual elimination of arcing not only prolongs the life of the contacts but also preserves the quality of the oil in the tap changer compartment.



MECHANICALLY

The load transfer switch, which is the only switch required to transfer load current, is provided with accelerating springs and is driven by Geneva gears. The design provides a means of opening and closing the load transfer switching elements at a high rate of speed without shock to the gearing or other parts. Moloney Load Tap Changers have been inspected in the field after more than 500,000 operations and have been found to have no mechanical wear sufficient to require replacement of parts other than contacts.



MOLONEY ELECTRIC COMPANY

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = BETTER PERFORMANCE, GREATER RELIABILITY, LESS MAINTENANCE

ME52-23

DOW

PENTA-TREATED POLES MAKE GOOD NEIGHBORS

Detroit Edison builds for the future and for its customers with clean, treated poles

The Dow Chemical Company
Dept. PE 3-2B2. Midland, Michigan

_____ Send me free booklet, "Pointers on Penta".

_____ Send me list of PENTA treating plants.

_____ Please have technical representative call.

Name_____

Title_____ Company_____

Address_____

City_____ State_____

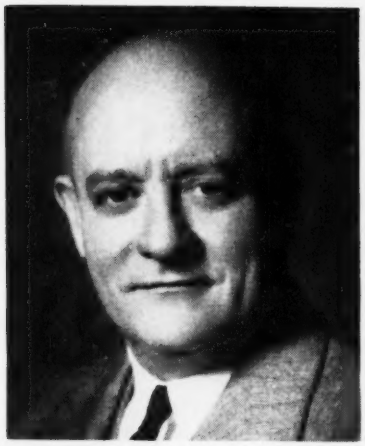
Looking for a *good neighbor policy?* Specify *clean*, full-length PENTA* treatment for all utility poles.

Over the years, PENTA-treated poles have been doing double duty for the Detroit Edison Company. In residential areas these poles are doing their share in maintaining good customer relations because they are clean, attractive—fit well in modern settings. They are also keeping repair and replacement costs at a minimum by resisting decay and termite damage. PENTA-treated poles last many years.

Specify clean, PENTA-treated poles for all settings—they make good neighbors, save you money. Write Dow today for complete information about *clean* *PENTAchlorophenol, the modern wood preservative. THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS

DOW



JOHN T. KIMBALL

A. H. FORMAN, JR

Arizona PS Officials Advanced

Kimball and Forman are promoted to the post of executive vice president. Liecty gets additional duties

Arizona Public Service Co has announced major changes in its executive organization. Vice Pres John T. Kimball has been named to the post of executive vice president in charge of the sales and service group and Vice Pres A. H. Forman, Jr, has been made executive vice president in charge of planning and production.

In other changes Treasurer John L. Liecty received added duties as head of the financial and accounting group. Vice Pres D. B. McGregor was assigned new responsibilities as head of the sales and personnel departments.

Served Predecessor Utility . . . Kimball, Forman, and Liecty had served with Central Arizona Light & Power Co until it was merged with Arizona Public Service last March.

Kimball joined Calapco in 1946 as manager of research and development, the position he held until his appointment as assistant to the president in 1947. Two years later he was elected a vice president of Calapco. Before going to Calapco, he served 12 years with Mississippi Power & Light Co.

Forman started with Calapco in 1949 as assistant to the president and was made a vice president the following year. Prior to joining Calapco, he had been assistant to the vice president of Mississippi P&L.

Liecty began with Calapco in 1936. He had served as assistant secretary and assistant treasurer before he was advanced to treasurer and assistant secretary in 1950.

Dallas Power & Light Elevates C. A. Tatum

C. A. Tatum, vice president of Dallas Power & Light Co, has been promoted to assistant to the president, George L. MacGregor.

P. M. Rutherford, Jr, was named commercial department head to succeed Tatum.

Tatum joined Dallas P&L in 1928. He was made commercial manager in 1939, and vice president in 1950.

C. A. TATUM

Oklahoma Utility Group Elects Wolfe President

W. R. Wolfe, vice president, Oklahoma Gas & Electric Co, has been elected president of Oklahoma Utilities Association for 1953. Wolfe, who served the association as first vice president during 1952, succeeds Richard W. Camp, vice president, Consolidated Gas Utilities Corp.

Other officers elected were: Earl J. Newlin, vice president, State Fuel Supply Co, first vice president; Harry W. Pitzer, vice president, Public Service Co of Oklahoma, second vice president; and H. H. Ferrin, vice president and treasurer, Oklahoma G&E, treasurer.

Wolfe, who graduated from the University of Oklahoma with an electrical engineering degree in 1926, went to work for Oklahoma G&E that same year. He spent two years in the Oklahoma City engineering department before being transferred to Muskogee, where he first served as power sales engineer and later as commercial manager. In 1942 he was named manager of the Eastern Division. He held this position until 1946 when he returned to Oklahoma City as assistant to vice president. He was appointed vice president in 1947.

W. R. WOLFE

•

E. A. Rodrique, assistant division manager of Louisiana Power & Light Co's Southeastern Division, has been promoted to division manager to succeed **Roy E. Ridnour,** who has retired. Rodrique, who joined Louisiana P&L in 1933, was appointed to the assistant

This book answers your questions about Microwave Communications Systems

Have you been wondering whether a Microwave System is the answer to your communications problem? Then you should write, wire or phone for a copy of this brand-new RCA manual. It's free to executives of utilities, pipelines, railroads and other right-of-way companies.

It tells how many companies with far-flung operations and need for "along-the-way" communications are already using microwave. How these companies have found it the most economical type of communications system (channel-for-channel). How in direct day-by-day comparisons they have found it the most reliable of all systems. And it tells how you can go about planning a system that will fit your needs.

RCA
MICROWAVE COMMUNICATIONS SECTION
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

Don't Delay—WRITE TODAY!

RCA Engineering Products, Dept. 45 NDCamden, N. J.
Please send me your new, free booklet *Introduction to Microwave.*

NAME_____ TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

division manager's post in 1949. Prior to joining LP&L in 1928 as division manager, Ridnour served with Central Louisiana Electric Co, Inc, and Home Light & Power Co.

Myron T. Smith, sales engineering manager of General Radio Co, Cambridge, Mass., since 1944, has been named sales manager. **S. W. DeBlois** has been made export manager. Smith started with General Radio in 1931 and DeBlois joined the firm in 1946.

GORDON R. COREY

Corey, Lungren New VPs of Commonwealth Edison

Gordon R. Corey and E. E. Lungren have been elected vice presidents of Commonwealth Edison Co.

Corey, who has been comptroller of the Edison company and Public Service Co of Northern Illinois since 1951, was also elected a vice president of Public Service. He started with the Edison system in 1939 when

E. E. LUNGREN

New G-E Rapid Start lamp needs no starter, cuts maintenance

IN THE NEW RAPID START lamp circuit G-E has been able to eliminate the starter required in standard lamps to pre-heat the cathode. For that reason, maintenance is even easier, more economical than before.

This new General Electric *Rapid Start* lamp was made possible by two G-E developments: an improved triple-coil cathode that replaces the double coil in standard fluorescent lamps, and a *Rapid Start* ballast. Together, they give General Electric *Rapid Start* lamps almost instant starting and smooth, simple operation.

G-E *Rapid Start* fluorescent lamps are rapidly becoming available. Many leading fluorescent lighting fixture manufacturers are incorporating the new lamps and ballasts in their latest equipment. These two newest developments of G-E research are another reason why you can *expect* the best value from General Electric fluorescent lamps.

You can put your confidence in—

GENERAL ELECTRIC

GET GROUND LEVEL EFFICIENCY

40* feet High with the Industrial Monkey

...the foot-controlled telescoping boom that takes the man straight to the job with BOTH HANDS FREE FOR WORK

Enable your men to work at ground level efficiency when the job is forty feet high! They'll get *more* work done, safer, faster and at *less* cost with an Industrial Monkey. You'll save man-hours, time and operating costs on *all* high work jobs. The Industrial Monkey pays for itself in savings alone in a surprisingly short time!

The Monkey—a hydraulically-operated telescoping boom with an insulated (24,000 volts) self-leveling cage—has been *job-tested* and *experience-proved* to become standard equipment with many utility companies.

The Monkey operates from horizontal to vertical with a 270° arc and is foot controlled with dual controls in the truck cab. *The operator has both hands free for work!* Cut the high cost of high work with Industrial Monkeys!

***40 feet, ground-to-floor of platform**

PLUS the man's height

PLUS his reach

Call, write or wire* TODAY *for complete details.

THE DONWILL COMPANY

835 S. E. MAIN STREET, PORTLAND 14, OREGON

MOBILIFT CORPORATION • 2317 W. 18th, CHICAGO

790 PATTERSON AVE., E. RUTHERFORD, N. J. • 2724 TAYLOR ST., DALLAS

1113 SPRING ST. N. W., ATLANTA • 2730 SAN PABLO AVE., BERKELEY

he was assistant to the president of the former Western United Gas & Electric Co.

Lungren, who started with the Western United company 38 years ago, has been vice president of Public Service in charge of gas operations since 1948. He will continue to direct the gas activities.

Julian Sprague Is Named Head of Sprague Electric

Julian K. Sprague has been elected president of Sprague Electric Co, North Adams, Mass., succeeding his brother, Robert C. Sprague, who resigned to accept the post of Under Secretary of the Air Force. The new president previously served as vice president of the company.

Since resigning from the presidency of the firm, Robert Sprague has not assumed the Air Force post because he declined to sell his family interest in the electric company, which he founded 27 years ago. The sale of these interests would have complied with a law that forbids officials to transact any business with companies in which they have a pecuniary interest. He is expected to become chairman of the board of directors of Sprague.

In other appointments, Ernest L. Ward, who has been in charge of manufacturing activities, has been appointed executive vice president.

ROBERT C. SPRAGUE, left, founder of Sprague Electric Co, is shown congratulating his brother, Julian K. Sprague, right, just after the announcement was made of the appointment of the latter to the post of the president of the Massachusetts electric firm

William J. Nolan has been made vice president, employee relations, and Neil W. Welch has been named director of sales. Robert C. Sprague, Jr. director of employee relations, succeeds his father as a member of the board.

Elected a Vice President

J. C. Hicks has been appointed vice president in charge of sales for Harvey Hubbell, Inc., Bridgeport, Conn., manufacturers of electrical wiring devices. He replaces Emmett K. Moore, who is retiring after 21 years' service. Hicks was formerly general sales manager of Sylvania Electric Ltd, Montreal, Can., a subsidiary of Sylvania Electric Products, Inc.

•

Francis McQuillin, who has served as assistant to the president of West Penn Power Co, Pittsburgh, since 1948, has retired after 35 years' service with the company. McQuillin, who became affiliated with West Penn in West Virginia in 1918, was industrial sales manager for 19 years before he was promoted to assistant to the president. He is a past president of the Pennsylvania Electric Association.

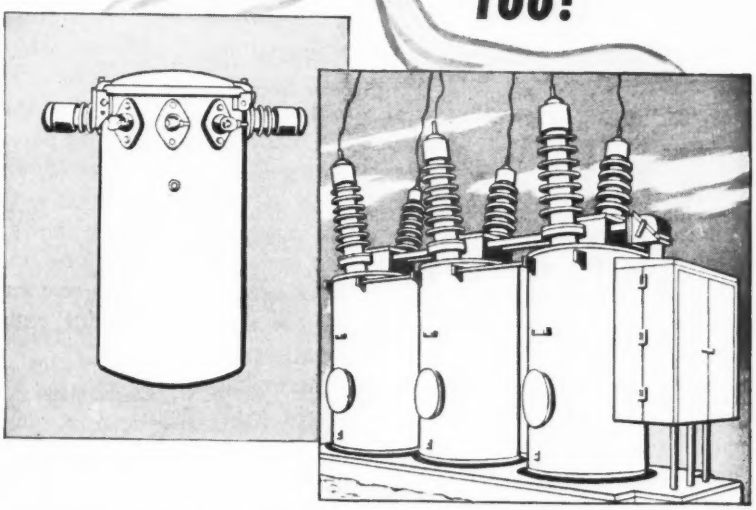
Milton A. Read, superintendent of accounts for Wisconsin Power & Light Co at Janesville, will become manager at Delavan when **Jesse E. Lauderdale** retires from active service March 1. With Wisconsin P&L since 1933, Lauderdale was assigned to the manager's post at Delavan in 1940.

OBITUARY

Charles A. Booth, 76, executive vice president of Buffalo Forge Co. Buffalo, New York, died there recently. Booth, a member of the American Society of Mechanical Engineers, started with Buffalo Forge in 1900. He was made sales manager in 1907 and vice president and director in 1917.

H. D. McDonald, 66, superintendent of Carolina Power & Light Co's hydroelectric plant at Waterville, N. C., died at Newport, Tenn., Feb. 10. McDonald, an electrical engineering graduate of Georgia Institute of Technology, has been superintendent of the plant since its construction in 1929.

DBPC Inhibited Oil
in Circuit Breakers, too!



WHEN DBPC (Di-tert-butyl-para-cresol) is added to transformer insulating oils, their resistance to oxidation is increased and their useful life is greatly extended. The value of Koppers DBPC as an inhibitor for new or reclaimed oil has long been proved.

Now, it has been shown that DBPC-inhibited oil can also be used in circuit breakers. The oxidation inhibitor, DBPC, does not affect arcing time, rate of gas generation, rate of carbon formation, rate of carbon settling or rate of dielectric change.

For longer oil life, for greater resistance to oxidation . . . specify Koppers DBPC. It can be used in both transformers and circuit breakers and thus, simplifies inventory problems.

Most suppliers furnish DBPC inhibited oil on request. For your convenience we can supply a compounded oil solution of DBPC called Impruvol 20. The application of Impruvol 20 is as simple as the application of the insulating oil itself. Write for more information on use of DBPC inhibited oil in transformers and circuit breakers.

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PROSPERITY IN THE USA: How Deeply in Debt Are We?

How prosperous *are* the people of the United States? Previous messages in this special series have answered this question in part by recording the progress – relatively slow progress – we have made in increasing both the income and the wealth per person in the USA.

This fourth and concluding piece of the special series deals with the extent to which our prosperity should be discounted because it has been accompanied by an increasing volume of debt. Many correspondents have suggested to us that an individual or a nation can temporarily increase prosperity by borrowing, but in so doing lives on both borrowed goods and borrowed time. Our purpose here is solely to throw light on the question of whether or not we are now in that unenviable position.

On January 1, 1953, the total debt of the United States government and of its citizens was $627 billion, as shown in the table below. On its face, a debt of this magnitude, which represents about $3,900 of debt for each person, suggests that we are heavily debt-ridden.

TOTAL DEBT – PUBLIC AND PRIVATE

Federal government debt	$267 billion
State and local debt	30 "
Private debt	
Corporations	195 "
Individuals	135 "
	$627 billion

The burden of our debts, however, does not depend simply on their size. It depends in much more decisive degree on our capacity to carry the load successfully. This capacity, in turn, is partly a matter of attitude, and attitudes defy objective measurement. A community that gets very jittery about its debts has less capacity to carry its burden successfully than one that does not. But the accurate measurement of jitters, present or prospective, still remains to be mastered.

Capacity to Carry the Debt Load

Nonetheless, it is possible to throw some light on our capacity to carry the debt burden by studying key economic elements that can be measured with some degree of accuracy. The following paragraphs indicate how some of these key economic elements stand.

Compared with our national income, the total volume of our debts, public and private, is still well below the level of 1929, when it proved to be too big for the good of the country. Our total debt is now 113% greater than the national income whereas in 1929 it was 146% greater.

There are several other cheering facts about our debts. One is a sharp decline in interest rates which makes the cost of carrying our debts relatively much less than it was in 1929. It took 8% of our total national income to carry our debts in 1929; it takes only about 5% of the income today.

More Cheering Facts

We also have much more ready cash now than in 1929. Today individuals and corporations hold a total of $269 billion in cash or its equivalent which is almost twice as much as the portion of private short-term debt (about $140 billion) that is subject to sudden demand for payment.

Many students of the subject cite the relatively low cost of carrying our debts and the large volume of cash on hand, and reach the comfortable conclusion that our debt burden is nothing to worry about. In further support of this view they emphasize the fact that no important part of our debt is owed abroad. Hence, they reason there is not the danger, so conspicuous in Britain since the end of World War II, that our economy will be upset by the necessity of making heavy debt payments to other countries.

Some Dangers of Present Debt

However, the nature of our debts presents dangers that it would be foolish to ignore. This is true of both the debt of $267 billion owed by the federal government to its citizens and the $330 billion in private debts owed by some citizens and corporations to others.

Public debt can be a dangerous kind of debt because government has the power to print money or to create its equivalent by expanding bank credit. Of the $215 billion that the federal government borrowed during World War II, over $90 billion was borrowed from banks. This was the largest single contributor to the inflation of prices that since the war has robbed the dollar of about half of its purchasing power, and thereby robbed the buyers of government bonds of about half the purchasing power these bonds were supposed to represent.

If, as is quite possible, a new emergency should again require the federal government to borrow heavily while its debt remains so high, it is doubtful that the public would be avid to buy its bonds. Hence, the government might again be forced to resort to the inflationary process of relying on bank credit.

Private debts can be dangerous if the people take on new debts more rapidly than is justified by the growth of business or by their ability to repay. Last year bank loans were increased by the imposing sum of about $6½ billion, which represents an increase of about 11% in total loans outstanding. This is almost twice as much as the increase in the volume of business over the same period. Installment credit for consumers increased by $3 billion last year, again an increase in debt about twice as great as the increase in business volume in the fields where the credit was used. It is also the fastest rate of such growth in our history.

Constructive Use of Credit

So long as the expansion of credit does no more than keep pace with expansion in the volume of business, the expansion is constructive. Also, when credit is expanded to acquire resources and equipment that will enlarge the volume of business a little later, that use is clearly constructive. But when private credit expansion begins to run ahead of business growth, it is time for us to be heads up. Such credit expansion courts price inflation. It also creates a forced draft under business so that, if credit is cut off, there may be a painful drop.

To give a summary answer to the question: *Is the level of debt in the United States a danger to our prosperity?* — the answer seems to be, "Not at the moment." We owe nothing abroad. The interest burden on present debt is relatively small, and we appear to have the resources to handle the short-term debt. Yet both the total amount of debt and the recent rapid increase in total private debt, especially the latter, are enough to signal for caution. We need restraint on the part of business and consumers to avoid expanding private borrowing at an excessive rate. The federal debt needs to be reduced and put in more manageable form. If these things are done, we can proceed to build a sound prosperity.

McGraw-Hill Publishing Company, Inc.

Copper Tariff Suspension . . .

. . . extended until 1954 as President Eisenhower signs bill continuing practice of dispensing with 2¢-a-lb duty

The copper tariff suspension, which was due to expire Feb. 15, has been extended until June 30, 1954. President Eisenhower signed the extension bill last week—one of the first half-dozen bills signed into law by the new White House occupant.

The extension bill was introduced early in January by Rep Daniel A. Reed (R, N. Y.), chairman of the House Ways and Means Committee. Like previous copper tariff suspension laws, the new act provides for the 2¢ tariff return when the domestic copper price falls below 24¢ a lb during one calendar month. Another bill, by Rep James T. Patterson (R, Conn.), which didn't come up for a vote, would have pushed the tariff suspension up to June 30, 1955.

Met Nominal Opposition . . . The extension bill sailed smoothly through Congress with only nominal opposition in the Senate—mainly by senators from Western mining states. Major proponents of the extended tariff suspension were Connecticut Senators Prescott Bush and William A. Purtell. Their big argument: Domestic copper production is inadequate to meet national requirements. About 600,000 tons must be imported annually, so why burden the essential copper-consuming industries with an import tax of $40 a ton?

The 2¢-a-lb tariff on foreign copper was originally suspended in 1947 for two years. In 1949 the suspension was extended until June 30, 1950. The tariff suspension was then reimposed April 1, 1951.

Forecast Price Hike . . . Copper will be among the last materials to be decontrolled by Office of Price Stabilization. Best guess is that decontrol will occur about April 1. OPS officials forecast a price hike of 5 to 9¢ a lb for domestic copper when price control is removed. The present ceiling is 24½ ¢. Foreign copper—now priced at 36½ ¢ a lb—will presumably fall to the domestic level.

National Production Authority's Copper Division estimates that copper supply will come into balance with demand only when armaments production can be safely curtailed, the strategic stockpile objective is reached, or when new domestic and foreign copper mines start coming into production during 1954 and 1955.

Monthly refined copper allocations are currently about 10,000 tons short of requirements. About 75,000 tons of domestic copper are now available monthly. When price control is dropped, it is expected that monthly supplies will be boosted about 5,000 tons.

The Controlled Materials Plan has been "open-ended," effective immediately.

The effect: Consumers can now buy copper products—and steel and aluminum—in excess of their regular allotments if they can find mills to supply them. Conversely, the mills are now able to sell to any customers as soon as the CMP orders have been filled.

Previously, as additional mill space developed, producers were unable to sell unless customers were issued supplemental allotments by NPA.

Allocations of refined copper to brass mills, wire mills, and foundries will continue until June 30.

MANUFACTURING BRIEFS

Kaiser Aluminum & Chemical Corp has opened its $12-million bauxite mining operations in Jamaica, British West Indies. The firm's first 10,000-ton shipment of aluminum ore has been sent to its Baton Rouge, La., plant for processing. Operated by Kaiser Bauxite Co, a subsidiary, the properties will have an annual capacity of about 2 million tons with reserves estimated sufficient for 50 years.

General Electric Co has broken ground for a new $500,000 service shop and warehouse in Portland, Ore. The 44,000-sq ft building is scheduled to be completed for June 30.

Sylvania Electric Products, Inc, is offering 550,000 shares of common stock at $36.625 a share through an underwriting group headed by Paine, Webber, Jackson & Curtis. The company is also offering $20 million of 4% sinking fund debentures due in 1978 at 100% and accrued interest.

Rome Cable Corp has set March 25 as redemption date for all outstanding 4% cumulative convertible preferred stock at $31.29 each. On or before March 24, holders can convert into common stock at the rate of 1.59 shares of common for each preferred share held.

SALES ASSIGNMENTS

COMPANY STAFFS

National Supply Co, Pittsburgh, has appointed Eugene F. Conroy district manager of the New York office of its Spang-Chalfant Division. Conroy, assistant district manager in New York since 1946, succeeds W. J. Stanton, who has retired after 20 years' service.

Sprague Electric Co, North Adams, Mass., has named George S. Kariotis as sales manager of its southern California branch office at Culver City. For the past year Kariotis has been serving in Los Angeles as assistant to Thomas S. Bills, who has resigned from the sales manager's post. William M. Lana, who has been head of the firm's branch office at Dayton, Ohio, has been made Kariotis' assistant.

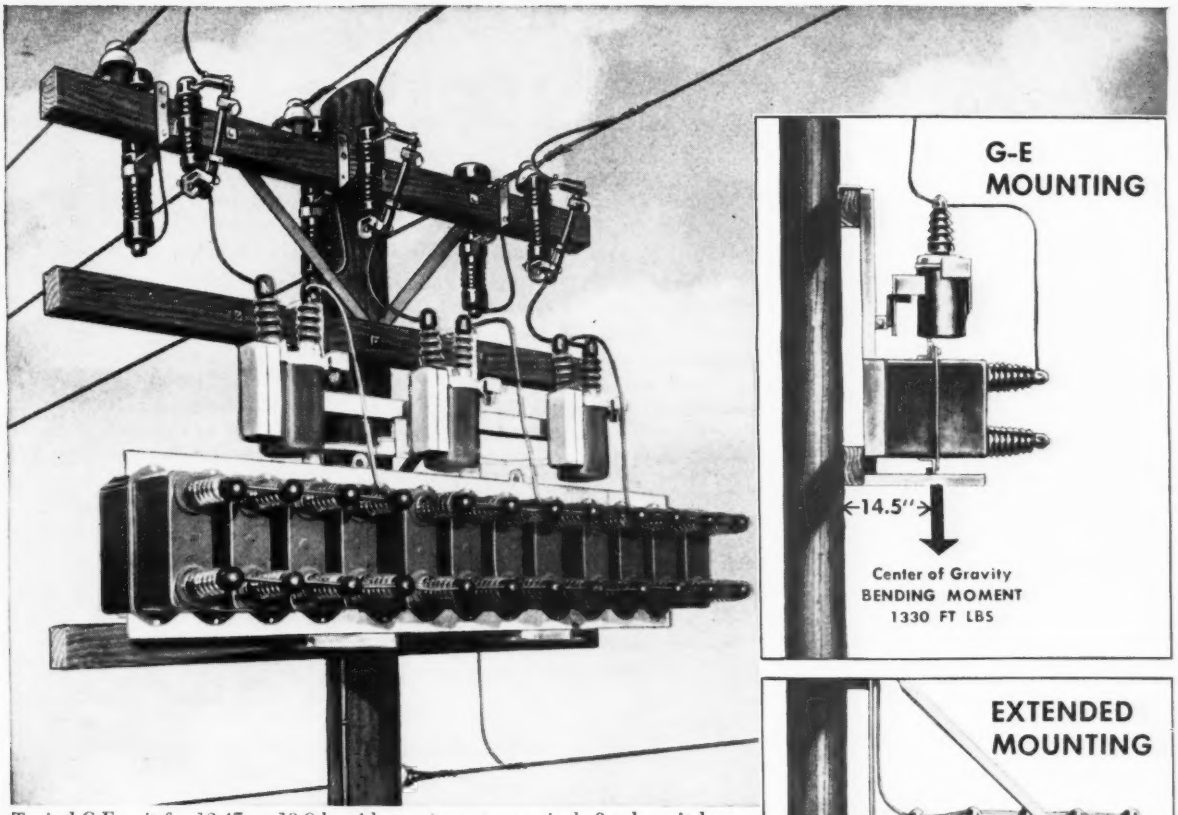
REPRESENTATIVES

American Steel and Wire Division of United States Steel Corp has named Standard Wire & Cable Co as its southern California distributor of electrical wire and cable. Standard W&C recently moved to larger quarters at 3140 Overland Ave., Los Angeles.

MANUFACTURERS' EARNINGS

Company	Period Months Ended		Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
Avco Manufacturing (a)	12	Nov.	$11,028,927	$10,089,214	$1.20(b)	$1.10(b)
Continental Radiant Glass Heating	4	Nov.	61,026	26,460	....	....
Okonite	10	Oct.	1,704,289	.....	11.24	....
Rome Cable	9	Dec.	1,550,000	1,101,000	3.17	2.24

Notes—(a) These figures have been audited; (b) Based on 8,890,824 shares in 1952 and 8,819,385 in 1951.



Typical G-E unit for 12.47 or 13.8 kv. 4-kv equipment uses single 3-pole switch.

G-E auto-switch equipment puts less strain and weight on pole

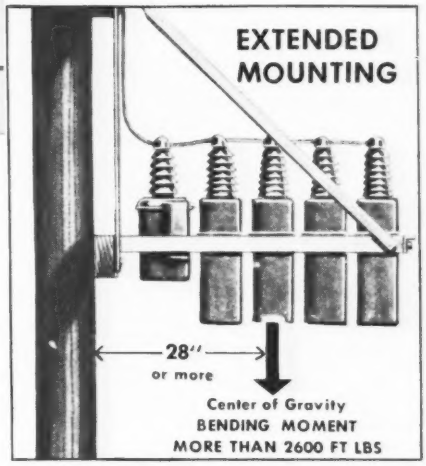
Side mounting of capacitors in General Electric auto-switch equipment brings the center of gravity of the equipment almost 50% closer to the pole than extended mounting. There's less strain on crossarms and poles. And because G-E capacitors are up to 25% lighter, the total weight on the pole is considerably reduced.

Neater, more compact design. G-E auto-switch capacitors—completely assembled, wired, and tested at the factory—arrive ready to install. All you do is hoist, bolt, and connect. Side mounting eliminates guy wires and extra braces—provides a neater, more compact appearance. Inspection and servicing are simplified.

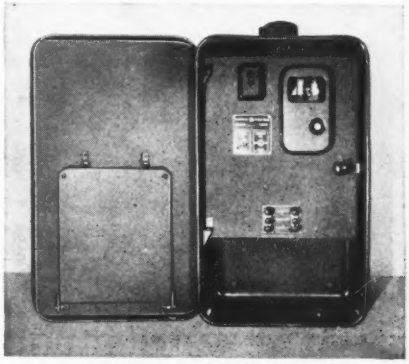
Voltage regulating relay, the same as used in G-E regulator control to provide Class I accuracy, assures reliable control regardless of temperature or weather changes. Voltage and/or current-sensitive automatic controls are available. Controls, enclosed in separate weathertight housing for mounting at the base of the pole, are easy to inspect.

Available in 225 and 300-kvar ratings, from 2400 to 13,800 volts, this compact auto-switch equipment costs you no more. Get in touch with your nearest G-E Apparatus Sales Office for more information. General Electric Co., Schenectady 5, New York. 407-40

GENERAL ELECTRIC



LESS OVERHANG. Exclusive side mounting of G-E capacitors brings center of gravity almost 50% closer to pole, reduces bending moment, puts less strain on crossarms and poles.



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Harvey Power Pact Approved

Secretary McKay sanctions contract calling for BPA to supply energy for firm's aluminum plant at The Dalles, Ore.

Power supply contract for Harvey Machine Co's proposed new aluminum plant near The Dalles, Ore., has been approved by Interior Secretary Douglas McKay. Bonneville Power Administration, an Interior agency, will furnish the power for the $65-million project.

Except for a few new twists, the contract is the same as those now in existence between BPA and aluminum producers in the area. The federal agency agrees to furnish Harvey 40,000 kw of firm and 80,000 kw of interruptible power beginning in early 1955. When sufficient new generation becomes available, possibly in 1956 or 1957, 20,000 kw of the interruptible will be placed on a firm basis. The contract covers a period of 20 years.

To Pay 'On-Site' Rate . . . Initial rates, subject to any area-wide increase adopted by BPA, are the same as those now in effect to wholesale customers: $17.50 per kw year for both firm and interruptible power at 100% load factor. When The Dalles hydroelectric project comes into operation, Harvey will pay an "on site" rate, which is now $14.50 per kw year. This, too, is subject to increase if and when BPA puts a system-wide rate hike into effect.

Three new clauses in the contract set it apart from those now in effect between BPA and aluminum producers:

1. Harvey will assume steam costs to the full extent of the firm power supply it receives should abnormally low-water conditions occur during storage seasons through 1956-57. This means the company will be subject to power surcharges now levied against customers of power systems which operate the steam generating plants during critical water periods (EW, Feb. 2, p 15). By this clause, BPA hopes to escape some of the criticism it is receiving from electric companies whose customers bear the brunt of the surcharge.

2. The contract is nontransferable. If the Harvey company as now constituted does not use the power, it cannot transfer it to a second company. This is to prevent a recurrence of Harvey's first aluminum try at Kalispell, Mont. The company negotiated a power contract for a proposed aluminum plant at Kalispell, but did not carry through. Anaconda Copper Mining Co took over, and gave Harvey a small share of ownership in exchange for the land, plans, and power commitments which Harvey had acquired.

3. Definite time schedules must be met by Harvey to validate the power contract. Unless the company can show by April 1 that financing is available, the contract can be terminated. If construction is not substantially underway by July 1, BPA has grounds for cancelling the contract.

MEETINGS CALENDAR

Canadian Electrical Association
Following Western Zone Division Meetings will be held at Palliser Hotel, Calgary, Alta.; Engineering, Feb. 23-25; General Division, Feb. 25-26; Sales Division, Feb. 26-27; Annual Convention, Manoir Richelieu, Murray Bay, Que., June 25-27.

National Adequate Wiring Conference
La Salle Hotel, Chicago, Feb. 26-27.

***Pennsylvania Electric Association**
Prime Movers Committee, Benjamin Franklin Hotel, Philadelphia, Feb. 26-27; Spring Meeting, Meter Committee, Hotel Alexander, Hagerstown, Md., April 23-24.

Southern Safety Conference-Exposition
Hotel Atlanta Biltmore, Atlanta, Ga., March 1-3.

Public Utilities Advertising Association
Region 1, Parker House Hotel, Boston, March 4-5; Region 5, Jefferson Hotel, Richmond, Va., March 12-13; National Convention, Chase Hotel, St. Louis, May 7-8.

Pacific Coast Electrical Association
Engineering-Operating Section Conference, Long Beach, Calif., March 5-6; Administrative Services Section Conference, Phoenix, Ariz., April 8-9; Annual Convention, Hoberg's, Lake County, Calif., May 13-15.

North Central Electric Association
Electrical Industries Meet, Hotel Nicollet, Minneapolis, March 8-11; Accounting Conference, Dyckman Hotel, Minneapolis, March 23-24; Accident Prevention Committee, Dyckman Hotel, Minneapolis, Minn., April 21; Distribution-Equipment Engineering Meeting, Dyckman Hotel, Minneapolis, April 22; South Dakota All-Electrical Industry Meeting, Ward Hotel, Aberdeen, S. D., April 24-25.

North Central Electrical Industries
1953 Electrical Industry Convention, Hotel Nicollet, Minneapolis, March 8-11.

National Association of Purchasing Agents
Public Utility Buyers Group, Mid-Winter Conference, Hotel Roosevelt, New Orleans, March 9-10; Annual Meeting, Statler Hotel, Los Angeles, May 24-27.

National Electrical Manufacturers Association
Winter Conference, Edgewater Beach Hotel, Chicago, March 9-12; Annual Meeting, Nov. 9-12.

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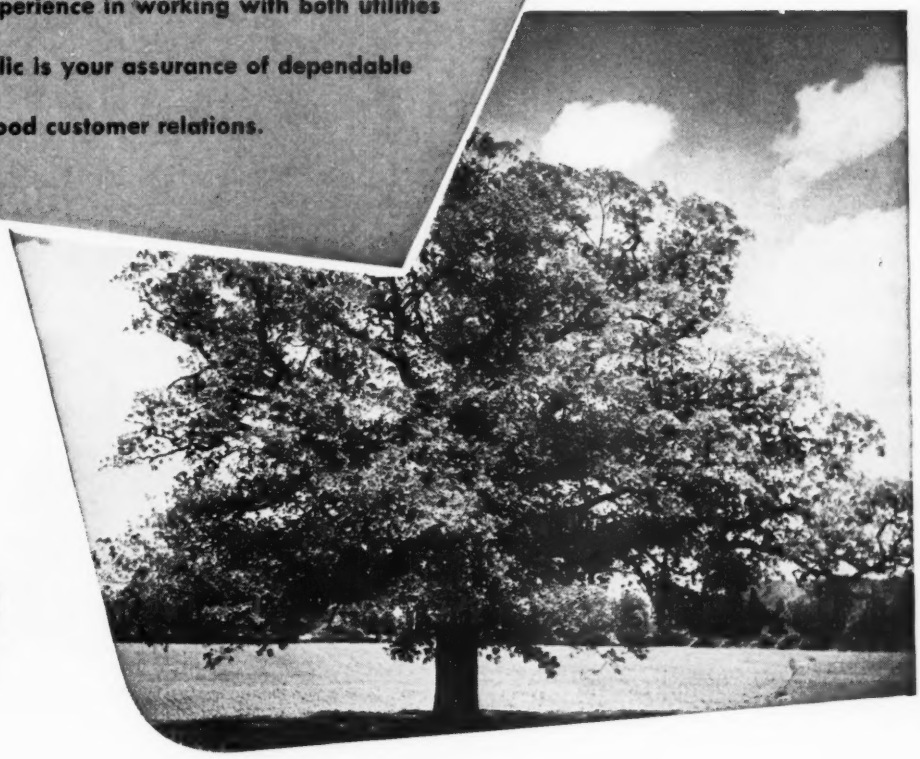

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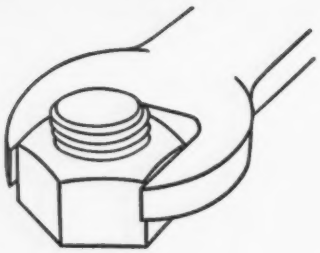
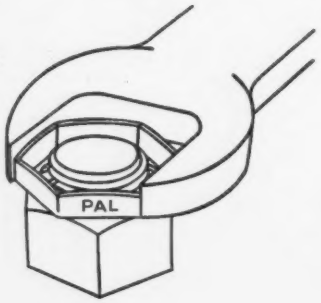


then KEEP it tight



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Illuminating Engineering Society
Canadian Regional Conference, Chateau Laurier, Ottawa, Ont., March 23-25; Southwestern Regional Meeting, Hotel Baker, Dallas, Tex., April 12-14; Pacific Northwest Regional Conference, Multnomah Hotel, Portland, Ore., April 23-24; East Central Regional Conference, Hotel Lord Baltimore, Baltimore, Md., May 14-15; Southern Regional Conference, Sedgefield Inn, Greensboro, N. C., May 18-19; Great Lakes Regional Conference, Syracuse Hotel, Syracuse, N. Y., May 25-26.

A&M College of Texas
Conference for Protective Relay Engineers, Dept. of Electrical Engineering, College Station, Tex., March 23-25.

Southeastern Electric Exchange
20th Annual Conference, Boca Raton Hotel, Boca Raton, Fla., March 23-25; Engineering-Operation Section, Edgewater Gulf Hotel, Edgewater Park, Miss., April 16-17; Industrial Power Sales Conference, Fort Sumter Hotel, Charleston, S. C., May 21-22.

American Power Conference
Annual Meeting, Sherman Hotel, Chicago, March 25-27.

* **Edison Electric Institute**
19th Annual Sales Conference, Edgewater Beach Hotel, Chicago, March 30-April 2; Accident Prevention Committee, Edgewater Beach Hotel, Chicago, May 4-5; Transmission-Distribution Committee, Edgewater Beach Hotel, Chicago, May 5-6; Electrical Equipment Committee, Sir Walter Hotel, Raleigh, N. C., May 11-12; Meter-Service Committee, Wentworth-by-the-Sea, Portsmouth, N. H., May 25-27; 21st Annual Convention, Atlantic City, N. J., June 1-4.

Missouri Valley Electric Association
Engineering Conference, President Hotel, Kansas City, Mo., April 8-10.

Northwest Electric Light & Power Association
Engineering-Operation Section, Multnomah Hotel, Portland, Ore., April 8-10; Business Development Section, Davenport Hotel, Spokane, Wash., May 4-6.

Northwest Public Power Association
Engineering-Operation Section, Osbourn Hotel, Eugene, Ore., April 16-17; Annual Convention, Ridpath Hotel, Spokane, Wash., May 6-8; Accounting Section, Monticello Hotel, Longview, Wash., Sept. 17-18.

Maryland Utilities Association
Annual Business Conference, Lord Baltimore Hotel, Baltimore, April 17; Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 18-19.

Electric-Gas Utility Accountants
National Conference, Sherman Hotel, Chicago, April 20-22.

American Institute of Electrical Engineers
Southern District Meeting, Hotel Seelbach, Louisville, Ky., April 22-24; Northeastern District Meeting, Copley Plaza Hotel, Boston, April 29-May 1; Summer General Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 15-19; Pacific General Meeting, Hotel Vancouver, Vancouver, B. C., Sept. 1-4.

Rocky Mountain Electrical League
Annual Spring Conference, Shirley Savoy Hotel, Denver, Colo., April 26-28.

American Society of Mechanical Engineers
Spring Meeting, Deshler-Wallick Hotel, Columbus, Ohio, April 28-30; Semi-Annual Meeting, Statler Hotel, Los Angeles, June 28-July 2.

Electrical Manufacturers' Representatives Association of Michigan, Inc.
1953 Electrical Exhibition, State Fair Grounds, Exhibition Bldg., Detroit, May 19-22.

National Association of Electrical Distributors
45th Annual Convention, Conrad Hilton Hotel, Chicago, May 24-29; Spring Meeting, Pacific Zone, Huntington Hotel, Pasadena, Calif., June 8-10.

American Society for Testing Materials
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 29-July 3.

Instrument Society of America
8th National Instrument Exhibit, Sherman Hotel, Chicago, Sept. 21-25.

* **Addition this week.**

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to support pole structures under adverse ice and wind loadings.

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to withstand the punishment incurred in construction and service.

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provided by famous *Crapo* Galvanized heavy, ductile, tightly-bonded zinc coatings.

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● Each size and grade of time-proved *Crapo* Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

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Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

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MUNCIE, INDIANA

DOW

BASAL BARK SPRAYING IS EFFECTIVE ALL MONTHS OF THE YEAR!

DOW'S Proved Brush Killers Control Brush and Trees in Any Season

Winter has been established as a good time for basal bark treatment. This important maintenance practice —spraying Esteron® 245 in oil on the basal 12-15 inches of brush stems or tree trunks—has proved its worth on many miles of roadside and right-of-way spraying.

When your spraying program includes dormant season basal bark treatment of brush and trees in addition to regular foliage spraying, you keep your crews busy and your application equipment in use more months each year.

Esteron 245 contains the powerful low volatility propylene glycol butyl ether esters of 2,4,5-T. Fuel oil, kerosene, used transformer or diesel oil serves as the carrier—special oils are not necessary. Esteron Brush Killer, a mixture of low volatility propylene glycol butyl ether esters of 2,4-D and 2,4,5-T, is also effective for basal treatment and can be used with either hand or power equipment. Stump treatment with either of these products can be done in any season, and makes manual cutting more effective as a brush control measure.

Dow sales and technical men are available for consultation and assistance. Call or write your nearest Dow sales office. THE DOW CHEMICAL COMPANY, *Agricultural Chemical Department*, Midland, Michigan.

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DOW

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FIRST NAME IN BRUSH KILLERS

REPORT:

Winter Basal Bark Spraying

It is smart, economical management to control brush along utility rights-of-way by dormant basal bark spraying. This is true for all sections of the country. It is particularly recommended for cotton...tobacco...truck crop regions.

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These benefits are proven not only by intensive research on Thompson experiment stations but by the field experience of many REA Co-ops, electric and telephone companies along hundreds of thousands of miles of line.

WHAT TO USE

For utmost economy and assurance of positive kills, we recommend our specially developed, modern low volatile brush killers:

BRAMBLCIDE
2, 4, 5-T

BRAMBLE-WEEDICIDE
2, 4, 5-T—2, 4-D

These brush killers are non toxic for humans or animals. They contain HS-31 for extra creep and extra kill. They are unmatched for efficiency and economy by any other known product.

Please write for data sheet on mixing and spraying and for price schedule.

Thompson
CHEMICALS CORP.
St. Louis 3, Missouri
Los Angeles 27, California

Visioneering

(*Continued from page* 102)

visioneering into action should be explained. If properly informed, all these salesmen of visual efficiency should and will cooperate with the program.

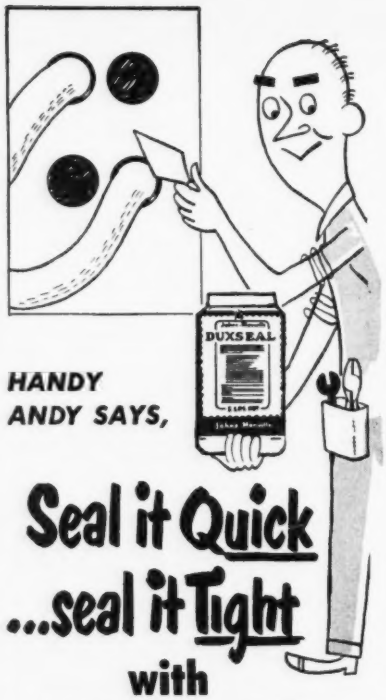
Pennsylvania Power & Light Co purchased a visual screening device and started its Visioneering Program in the Wilkes-Barre area in November. The paint people, vision experts, and lighting people are all very enthusiastic about the program and have pledged their full cooperation.

Visioneering Program . . . The next step would be for the individual industrial representative of the utility company to offer the visioneering program to local industries. Offer to do the preliminary visual screening by a vision expert at a small charge to the customer. The industrial customer, however, should be cautioned that he will have to explain the program to employees and probably to union shop stewards.

Having secured management's approval to conduct a visioneering program in its plant, the utility representative or a committee composed of a vision specialist, a member of the lighting industry, and a paint specialist should go out and analyze the visual jobs in the plant. They should visit the "scene of the crime" and, if possible, study the worker's job by actually doing it so they can learn at first hand all about the visual task. It is suggested that forms be filled in for such surveys. Copies of the survey for each job performed in the plant should be given to management and also to the vision specialist who will operate the optical device and evaluate the results. This is essential so all parties concerned may have a true record of the visual requirements of each job in the factory.

Screening Test . . . Having done this, every employee in the plant should have the benefit of the visual screening test. Each employee would then be told whether or not he needs glasses to correct poor vision.

While this is being accomplished, the lighting specialist, the paint company representative, and the vision expert should give their recommendations for improvements to the utility industrial representative. He in turn



HANDY ANDY SAYS,

Seal it Quick ...seal it Tight with Johns-Manville DUXSEAL

KEEP A PACKAGE of Duxseal in your tool box for on-the-spot sealing of duct openings, potheads, bushings, terminal boxes—and for filling multi-wire contact boxes indoors. It's a nonhardening adhesive plastic compound with an asbestos base . . . goes on like putty just as it comes from the handy package . . . provides a smooth, workmanlike job.

Check these 4 important advantages of Duxseal:

Stays plastic—Duxseal stays plastic indefinitely. Will not slump, melt or run under ordinary temperatures.

Stays tight—Clings to duct walls and cables but flexes with expansion and contraction of the cable.

Stays insoluble—Unaffected by ground waters and gases.

Stays harmless—Will not injure workmen's hands or react with rubber, metals or painted surfaces.

Tight seals for other electrical uses:

J-M Tranolseal . . . for use against refined oils employed in transformers, switches and similar equipment.

J-M Uniseal . . . for caulking equipment outdoors or in fume-laden areas. Resists temperatures up to 180° F.

Let us send you more information about Duxseal and other J-M labor-saving sealing compounds. Just write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto, Ontario.

JM

Johns-Manville
SEALING COMPOUNDS

could bind these recommendations together with copies of the Job Visual Requirements studies in a folder and present them to the factory management for action.

Stacked Capacitors

(*Continued from page* 115)

ported on concrete footings. This simplifies ordering, reduces erection costs, and provides easy means of changing the rating of the bank at a later date, or moving it to a new location.

A current transformer with insulation to match the system voltage rating can be connected between the two neutrals to energize relays for detecting capacitance unbalance. This is usually the most economical practical system and, therefore, the one most often used for detecting unbalance.

Fuses . . . The stacking units have individual outdoor fuse holders mounted on the horizontal bus above the capacitor units. A leaf spring serves to connect the end of each fuse refill with its capacitor unit. One end of this spring is attached solidly to the capacitor, so that the spring extends horizontally. Then the outer end of the spring is bent up and connected to the end of the fuse refill, thus putting tension on the spring. If the fuse element blows, this spring ejects the refill and then returns to a horizontal position.

Expulsion fuses have been common on individual capacitor units when the banks consisted of two or more groups of units in series, or when the neutral of the bank was floating free. With these arrangements a phase-to-phase fault is less likely, and therefore, use of this fuse involves only a slight risk.

Risk Minimized . . . This risk, however, is minimized in the new stack installation because the total phase-to-neutral voltage is divided between several insulators. A snake or other object could produce only a partial phase fault, and currents through the foreign object would thus be limited. The explusion fuse with its limited interrupting capacity is, therefore, entirely adequate.

The danger of operating the capacitor units above their rated voltage is eliminated easily by arranging the stacks to provide two separate ca-

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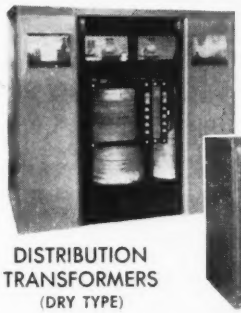

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3 KVA to 15 KVA
Air-Cooled

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*If you think this is just an advertising adjective we invite you to contact us . . . we will tell you who buys Magnatran —the better transformers . . . and if you want, show you how we build them.

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Adapter for attaching pruning saw available.

All steel heat treated head, cuts easily, holds cutting edge.

Special double steel hook practically eliminates bending, breaking and twisting.

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pacitor neutrals, so as to provide relay means sensitive to unbalance, and thus trip the breaker or sound an alarm.

If the bank contains only one group per phase, and these are delta connected, or wye-grounded neutral, it is desirable to use a fuse capable of interrupting or limiting the fault current magnitude and duration.

Best Location . . . With these new developments in capacitor designs it is now just as convenient to install shunt capacitors on high-voltage circuits as on any other circuit. This should make it possible to locate the capacitors on the system where they will best serve the purpose for which they are being installed. Also, if the installation is in a location where an open design is acceptable from a safety standpoint this "stack" construction is quite suitable for the lower voltage range from 460 v to 13.8 kv, as an alternate to the more costly metal-enclosed capacitor equipment.

Voltage Fluctuation

(*Continued from page* 118)

R_2 and battery B_2 will cause tube V_4 to be biased negatively beyond cut-off. Therefore, there will be no plate current in V_4 and no deflection of the oscillograph. Since condenser C is discharged, it is now ready to be charged again on the following positive half-cycle.

The same action takes place in a similarly arranged circuit for negative half cycles. Thus a continuous record of dots or blocks appears on the oscillograph film as shown in Fig 7, each dot representing one half-cycle. The distance of each dot from the reference line shows the value of the voltage being measured for that particular half-cycle.

Tests With Flicker Instrument . . . Oscillograms taken in laboratory tests made with the instantaneous flicker instrument are shown in Fig 9 and 10 using the circuit shown in Fig 11. Reading from top to bottom the voltages shown are:

(a) Line-to-line voltage BC at point P (Fig 11)

(b) Line current B to welder at P (Fig 11)

(c) Line-to-line voltage AB at point P given in the form of the output of the measuring instrument, i.e., a pulse

an ACCO product

Stainless Steel STRAND

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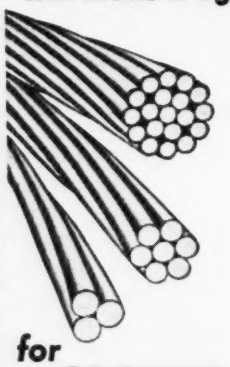
will make it again



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corresponding to the rms value of each half-cycle.

The three-phase resistance welder used was a frequency changer type and was adjusted to operate with 5½ cycles on and one cycle off for each half-cycle of current in the welding circuit. The purpose of the tests was to study the voltage fluctuations existing at P caused by welder operation and also to study the effect on these fluctuations of the presence of a motor load at P in parallel with the welder load.

The use of this intrument made possible a comparison of measured and calculated values of voltages at P. The non-sinusoidal character of the welder currents made a straightforward calculation difficult and therefore an approximate method of calculation was used.

At the end of the welder conduction period (Fig 9) the rms value of the voltage AB is given approximately by the average of the rms values for the last positive and negative half-cycles. Thus the rms voltage at the end of the welder conduction period at A is the average of 110.5 and 105.5 or 108.0 v. The difference between this value, 108.0 v, and the highest voltage reached during the welder "off" period, i.e., 116.8 v, was 8.8 v. By the proposed method of calculation this difference was predicted to be 8.4 v. Likewise at B the measured change was 9.7 v and the calculated value 9.0 v.

In Fig 10 the same quantities are recorded with the motor at P operating. The calibration scale was changed to keep deflections to a reasonable size. While an exact agreement was not expected because of the necessary approximations, the use of the instrument did make possible a comparison of measured and calculated values.

TECHNICAL LITERATURE

Microwave Equipment — DeMornay-Bonardi, Inc, Los Angeles, California, manufacturers of microwave equipment announces a unique booklet combining the additional features of a textbook and manual. The new volume is 134 pages of technical information on one of the most important electronic fields—microwave engineering. Eleven opening pages of the catalog graphically explain the basic concepts to microwaves. Including charts, graphs and drawings, this section enables the engineer to fully understand the principles behind the microwave equipment. Eleven phases on microwave test equipment measurements and calibration procedures is included.

KEES

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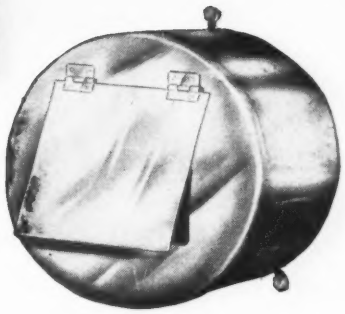

Fits all standard "S" Type meters

Made from 16 gauge zinc-coated, rust-resistant steel and finished in baked-on aluminum enamel, the KEES Socket Meter Cover is designed to prevent breakage of glass on socket meters and to insure long service in any climate. Outside diam.—8" and depth—5⅝". Metal cover is also reported to minimize damage from excessive current surge due to electrical storms.

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- Digs a straight hole from any truck position
- Adjustable for clean holes to 8 ft deep
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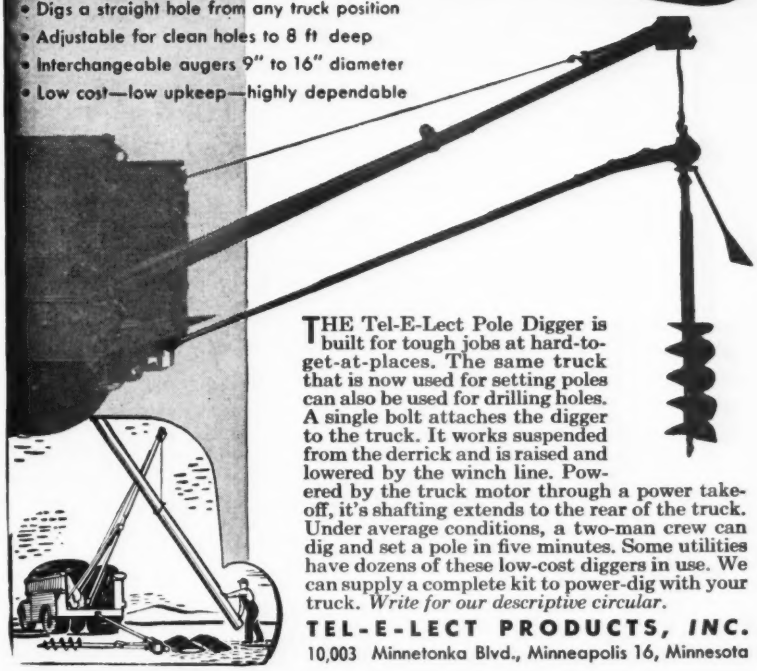

THE Tel-E-Lect Pole Digger is built for tough jobs at hard-to-get-at-places. The same truck that is now used for setting poles can also be used for drilling holes. A single bolt attaches the digger to the truck. It works suspended from the derrick and is raised and lowered by the winch line. Powered by the truck motor through a power take-off, it's shafting extends to the rear of the truck. Under average conditions, a two-man crew can dig and set a pole in five minutes. Some utilities have dozens of these low-cost diggers in use. We can supply a complete kit to power-dig with your truck. *Write for our descriptive circular.*

TEL-E-LECT PRODUCTS, INC.

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How not to "SHORT-CHANGE" Your Customers

. . . WHEN YOU SELL THEM TAPE!

While minimum length can be depended on to be accurate in every roll of tape, it's the *weight* of the roll that you must watch. It is important for you to know: Does the No. 4 Roll actually weigh 4 ounces, as it should; or the No. 8 Roll 8 ounces?

For weight reveals whether tape is full strength in substance, or whether its protective and adhesive properties have been weakened due to skimpy materials. Underweight tape results in customer dissatisfaction.

You can always weigh every roll you buy, of course, but why bother, when HAARTZ-MASON publicly makes you a DUAL GUARANTEE — a guarantee covering both weight and length, and prints this information boldly on every roll and container.

HAARTZ-MASON is currently promoting the importance of weight to your tape customers and urging them to look for weight information on every roll they buy. So avoid possible loss of tape sales by putting in a stock of the DUAL GUARANTEED HAARTZ-MASON brands today.

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Metallic Electrical Conductors—Sponsored by ASTM Committee B-1 on Wires for Electrical Conductors, this latest edition presents in convenient up-to-date form, the 46 ASTM standard and tentative specifications and methods of test pertaining to this field. In this special compilation four of the standards are new, while thirty-five are standards that have been revised. It represents the careful and considered technical opinions of competent leading authorities from producer and consumer interests of the industry. Copies of this 262 pg publication, with heavy paper cover, may be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa, at $3.00 each.

Magnets—A new chart, "What Makes a Magnet?" describing the natural forces causing magnetism and how they are harnessed to create a useful tool for industry and the home, is being offered free by the Eriez Manufacturing Company. The chart is made up of diagrams and drawings with explanatory captions. To obtain free copies of this chart, write to the company, 1945 Grove Drive, Erie, Pa.

Varnishes (Electrical Insulating)—A new booklet on Standards for Electrical Insulating Varnishes, the first ever issued, has just been announced by the National Electrical Manufacturers Association. Designed for manufacturers and repairers of electric coils and equipment who use a varnish in their operations, the new booklet contains information concerning the specific gravity, viscosity, drying time, non-volatile content, oilproofness and dielectric strength of several types of varnishes. These include spirit soluble, oxidizing air drying, thermosetting, oxidizing baking and asphaltic types. Copies of this new publication are available from NEMA, 155 East 44th Street, New York 17, N. Y., and they are priced at $2.50 per copy.

Sound Powered Electric Phones—The Wheeler Insulated Wire Co, Division of The Sperry Corp, Waterbury 20, Conn, is offering a new file size comprehensive catalog bulletin covering sound powered communications equipment for industrial and commercial use. The line includes the Pair Phone System, Multi-service Intercom System and a Master Phone System, together with detailed listing of special service equipment and high level handsets. Advantages of the sound powered electric telephones are completely explained. Installation information, wiring and dimension diagrams and description of special instruments are also included. Copies of this bulletin (SA-25) may be obtained by writing to the company at the address mentioned above.

Optical Instruments—Functions and general applications of seven types of optical instruments that aid production and quality control in industry are described in a new brochure that has recently been published. The 8-page booklet is illustrated with photographs, drawings, and technical data. It describes the use of contour measuring projectors, stereomicroscopes, toolmaker's microscopes, thickness gages, and other optical instruments that may be used as separate units or built into present equipment for rapid inspection and measurement of a multitude of tooling and production items. Particular emphasis is given to the contour measuring projector which is used extensively by mnufacturers and users of gears, cams, dies and other parts requiring accurate measurement of irregular contours, The brochure points out that a large group of company engineers "made a special effort to simplify the design and operation of these instruments so that even untrained operators can very quickly become skillful in their use." Copies of the brochure may be obtained without charge by writing to Bausch & Lomb Optical Co, 650 St. Paul St., Rochester 2, N. Y. Ask for Catalog D-22.

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Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

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Utility and industrial accounting, financing, evaluations, consulting engineering, reports, appraisals, rate studies, labor relations, public and employee relations, safety, insurance, pension plans, sales promotion.

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THE ONE-STEP METHOD

Bill Frequency Analyzer

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PROFESSIONAL SERVICES

REIS & CHANDLER, INC.
ADVISORS TO UTILITIES
Financing—Rate of Return
30 Vesey Street, New York 7, N. Y.

SANDERSON & PORTER
Engineers and Constructors
New York • Chicago • San Francisco

SARGENT & LUNDY
ENGINEERS
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Consulting Engineer
Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law, Appraisals.
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F. A. TUCKER, INC.
Contractors—Engineers
specialize in
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Construction and Maintenance
Transmission - Distribution
Electric and Telephone Lines
Consultants
501 York Road, Jenkintown, Pa.

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Design • Construction • Reports • Appraisals
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READERS MAY CONTACT
the consultants whose cards appear on this page with the confidence justified by the offering of these special services NATIONALLY.

What we want are clean treated poles that we can count on for *long* service!
Then you should use *creosote*. Proper pressure treatment combined with creosote of the proper specifications will give you dry, complaint-free poles that are *completely protected* against decay.

Remember . . . creosote is the *only* preservative that has kept wood sound and serviceable under severe conditions for more than 30 years.

KOPPERS COMPANY, INC., PITTSBURGH 19, PA.
Tar Products Division
DISTRICT OFFICES: Woodward, Ala. · Chicago, Ill., 122 S. Michigan Ave.
New York, N. Y., 350 Fifth Ave. · Boston, Mass., 250 Stuart Street
Los Angeles, Calif., 727 E. Gage Ave. · Pittsburgh, Pa., Koppers Building

KOPPERS
All Standard Specifications
Creosote
The Performance-Proved Wood Preservative

You can count on Koppers for Creosote!

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

RATES

UNDISPLAYED

$1.20 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

POSITION WANTED and INDIVIDUAL SELLING OPPORTUNITY undisplayed advertising rate is one-half of above rate, payable in advance

Box Numbers—Care of publication count as one line

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $11.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS: Address 330 W. 42 St., 36, N. Y., for March 9th issue closing Feb. 27th

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED—OFFICE Manager-Bookkeeper for system of 4400 members, 700 miles line. Annual revenue $500,000. In charge of Four office employees and all office routines. Bill done by IBM contract. Salary range $4000-$5000. NRECA insurance and retirement program. Vacations and sick leave. Electric cooperative accounting experience required. Lorain-Medina Rural Electric Cooperative, Wellington, Ohio.

WANTED JR. Sales Executive, 30 to 40, by well-known midwest electrical manufacturer, selling to utility trade thru jobbers. Duties: to assist sales manager. Some travel. E.E. or N.E., with sales experience preferred, but not a necessity. Replies held confidential. Salary open. Give complete resume and salary desires in first letter. P-6948, Electrical World.

SELLING OPPORTUNITIES OFFERED

SALES ENGINEER, age 25-40, some technical background desirable, to call on utility industry in midwest-southwest states from Chicago office of long established cable company. Permanent position, salary and expenses. State age, educ., experience, refs., sal. RW-6886, Electrical World.

WANTED MANUFACTURERS Agent to represent manufacturer of expanding guy wire anchors in North and South Carolina, Virginia, West Virginia, Georgia, Florida and Alabama. Must be a top producer. Advise lines you are now representing. RW-6932, Electrical World.

EMPLOYMENT SERVICE

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 43 years.) Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

SALES ENGINEER, twelve years successful experience selling electrical apparatus and distribution equipment. Interested in Sales Branch or Sales Managerial position with manufacturer. Age 39, Registered P.E. PW-6662, Electrical World.

ELECTRICAL ENGINEER, available for assignment in Latin America. 8 years of well diversified experience in heavy industry, generating stations power transmission, distribution & communications. Training in business administration. Fluent Spanish. PW-6957, Electrical World.

SELLING OPPORTUNITY WANTED

DETROIT-MANUFACTURERS' Representative needs established electrical equipment line to sell to Utilities and Industrials in Michigan. RA-6506, Electrical World.

OPPORTUNITIES FOR ELECTRICAL ENGINEERS WITH GOODYEAR ATOMIC CORPORATION

Electrical Engineers with BS or MS degrees, or the equivalent in training and experience, required to staff the Engineering Division of the Billion Dollar Atomic Plant now under construction near Portsmouth, Ohio. Fields of opportunities include:

- Design, Construction, Operation and Maintenance of High Voltage Transmission and Distribution Systems. Operating and dispatching experience on 154 KV systems highly desired.
- Design, Development and Maintenance of Electronic Control Systems.

Reply by letter stating education, work experience and salary required.

Industrial Relations Division
Goodyear Atomic Corporation
1144 East Market Street
Akron 16, Ohio

SALESMAN TO SELL ELECTRICAL CABLE MANUFACTURERS

World's largest manufacturer in its field offers excellent opportunity to a capable salesman with broad experience in selling products to Electrical Cable Manufacturers. Will also consider a man with thorough knowledge of electrical manufacturing interested in selling in that field.
Our personnel know of this advertisement and all replies will be held in strict confidence. Write

SW-6955, Electrical World
330 West 42nd Street New York 36, N. Y.

WORLD'S LARGEST INVENTORY

FREE CATALOG

MOTORS—GENERATORS—TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.

ELECTRIC EQUIPMENT CO
P. O. BOX 51, ROCHESTER 1, N.Y.

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

HAVE YOU A PACKAGING OR ASSEMBLING PROBLEM?

Let us help you eliminate much of your overhead, space requirements and help problems.

We offer open capacity for assembling and packing kits, sets, units, etc. according to Govt. Specs for domestic or overseas shipment. Also large warehousing facilities. Trackage to handle seven cars.

Responsible and experienced management, ample number of workers. Location: midwest city. WRITE US TODAY.

CW-6856, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

FOR SALE
LOCOMOTIVES
Three 4 ton and one 7 ton Jeffrey electric trolley locomotives, Type DM, class 40, form H, 220 to 250 volts DC.
KLATZKY BROTHERS, INC.
Calumet, Michigan

DIESEL GENERATING UNIT
Available Immediately
Enterprise DSG6 300 KW
3 Phase 2400 Volt Skid Mounted
Excellent Condition
Craig-Botetourt Electric Cooperative
New Castle, Virginia

99-LINE AUTOMATIC ELECTRIC SWITCHBOARD
With battery eliminator. 40 automatic telephones. In first class working condition. Excellent Price.
Contact: D. R. Welch
1918 South Evanton
Tulsa, Oklahoma *Phone 9-4937*

FOR SALE
Unused G.E. 1750 H.P. Motor
3600 RPM, squirrel cage induction, complete with starting switchgear.
PITTSBURGH CONSOLIDATION COAL COMPANY
Research and Development Division
Library, Pennsylvania

WANTED

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES
No lengths too long or too short
Telephone: Eastgate 7-4778
PIERCE CABLE CO.
2670 Clybourne Ave. Chicago 14, Illinois

—WANTED—
Meters
Any Quantity *Vanderbilt 6-1955*
ATLANTIC Electric Meter Corp.
214 E. 41 St., New York 17, N. Y.

WANTED—SUBMARINE CABLE
1000 Ft. 2/C #8 600V, Oil Base Compound, Jute Filler, #12 AWG Steel wire Armor Over All.
HECKLER ELECTRIC COMPANY
44 Schenectady Ave. Brooklyn 13, N. Y.
Phone . . . PR. 4-3700

REBUILT AND NEW

GUARANTEED MOTORS

M.G. SETS • GENERATORS

Hoists • Compressors • Transformers
Units of Every Size and Description

M. G. SETS

K. W.	Make	A.C.	D.C.
2400	A.C. (3-unit)	4800	525
2400	West. (3-unit)	4800	600
1000	G.E. (3-unit)	11000	137½/275
1000	West. (3-unit)	11000	137½/275
500	A.C.-Westgh.	2300	250
500	Cr.-Wh.	220/440	250
450	G.E. (3-unit)	2300	125/250
400	A.C.	2300	120/240
250	Westgh.-G.E.	440	250
200	Ridgeway	220	250
150	G.E.	2300/440	250
150	G.E.	2300/4000	125/250
150	G.E.	440	275
100	G.E. (25 cy)	440	125
100	G.E.	2300	250
100	Delco-G.E.	440	120/240
90	G.E.	440	60
75	A.C.	440	250
60	A.C.	2300	110
60	G.E.	440	250
40	Cr.-Wh.	220	125
40	A.C.	220	125
40	G.E.	220	125
35	G.E.	440	125
25	Westgh.	2200	125

TRANSFORMERS

KVA	Make	Ph.	Pri.	Secondary
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	455
667	G.E.	–	33000	480
333	A.C.	1	14400	240/480
300	G.E.	3	13800	240/480
300	G.E.	3	2400	240/480
200	Wagner	1	2400	575
167	A.C.	1	2400	120/240
100	Pitts.	1	2400	575
100	A.C.	1	2400	120/240

AC SYNCHRONOUS MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts
(*2200 Volts or Higher)

H.P.	Make	Type	P.F.	Speed
2500	*A.C.		1.0	514
1420	*Westgh.		.7	900
720	*G.E. (25 cy)	ATI	1.0	750
700	*G.E.	TS975Z	1.0	1200
600	*G.E.	TS7640	1.0	900
400	Westgh.	22E38	1.0	900
300	G.E.	ATI	.8	900
300	Ideal	SNS	1.0	257

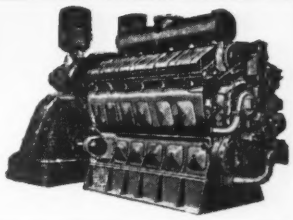
WE'LL SELL, BUY OR TRADE
PHONE CANAL 6-2900

CHICAGO *Electric Co.*

1324 W. CERMAK ROAD
CHICAGO 8, ILL.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS–217	2800	225	320	Enterprise	DSG–6	560	450
1500	Fairbanks Morse	33E16	2000	300	300	General Motors	8–268A	450	1200
1136	Fairbanks Morse	38D	1600	720	250	Fairbanks Morse	37–E	375	360
1100	General Motors	16–278A	1600	720	200	General Motors	8–268A	350	900
750	General Motors	12–567	1080	720	150	Worthington	CC–4	225	450
500	Baldwin	VO–8	750	514	150	Buckeye	80	240	600
500	General Motors	8–278A	750	720	100	Worthington	BB–5	150	600
500	General Motors	8–567	720	720	100	General Motors	3–268A	150	1200
400	Ingersoll-Rand	S–8	600	720	60	General Motors	6–71	90	1200
350	Baldwin	VO–6	510	450	30	Internat'l Harvester	UD–14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Qu.	KW	Make	Resc.
1—	1000	G.E.	Non-Cond—190 lbs—2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs , 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1—	400	Westgh.	Non-Cond—125/150 lbs., 5/10 lbs. B.P., 240/480-3-60
1—	300	G.E	Non-Cond 150/175 lbs., 5/10 lbs. B.P., 480-3-60

FREQUENCY CHANGERS

KVA	Make	RPM	Voltages	Frequency
1—3750	G.E.	300	2400/4150– 2400/4150	25/60/25
1—3125	G.E.	300	2400/4150– 2400/4150	25/60/25
2—2500	G.E.	750	2400/4150– 2400/4150	25/62½/60/24

MOTOR GENERATOR SETS
3 ph, 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	6600/13200
2—	2000	G.E.	500	666	25 cy. 11000
1—	1500	G.E.	720	600	13200
1—	1500	G.E.	360	275	2200/4400
3—	1500	G.E.	514	250	6600/13200
3—	150	G.E.	600	600	2300/4150
1—	1000	G.E.	900	260	4100/6900
2—	1000	Whse.	900	600	2300/4158
1—	500	Whse.	900	250	6609/13200
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300
1—	350	G.E.	900	125	4150
1—	150	G.E.	1200	275	2300
1—	150	Whse.	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
3—1250	G.E.	HVDDJ		6600x550
1—1150	A.C.	OISC		13200x480/2400
3—1000	G.E.	HVDDJ	1	2200x480
5— 300	G.E.	HT	3	2400x240/480

BELYEA COMPANY, INC.
OFFICE & SHOP
51 Howell St. Jersey City 6. N. J.

Transformers for Sale

1 Westinghouse Outdoor type 3 Ph 300 KVA, 60 cy. 550 O.I.S.C. 11500-460 Serial 1218213 2—5% Taps by Tap Change.
1 G. E. Outdoor type 3 Ph, 300 KVA 32 H-894-GRI H. T. 60-300 x 12000, 240 x 480R Serial 8639151 New 1949. These units are in use and will be available later in the year on a changeover of voltage. Or a negotiation will be considered whereby we receive in the exchange, 3—100 KVA 60 cy. 1 Ph 460—115—230.

Location—Chicago District.

W. J. HOLLIDAY & COMPANY
545 WEST MC CARTY STR.
INDIANAPOLIS 7, INDIANA

-TRANSFORMERS-

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes. One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 **CINCINNATI 27, OHIO**

TURBO GENERATOR
Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION

Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

VARIABLE SPEED DRIVES
FREQUENCY CHANGERS
LOW-VOLTAGE GENERATORS

American **ELECTRIC CORPORATION**
DEPT. P, Box 133, INDIANAPOLIS, IND.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

1606 53rd ST., NORTH BERGEN, N. J. N.Y.C. Tel. LOngacre 5-3227 N. J. Tel. UNion 3-2600

TRANSFORMERS
1—1500 KVA G.E., 3 Ph., 4150V. 2300V Pyranol
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/480V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V sec.
2— 200 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
1— 200 KVA G.E., 3 Ph., 2400-220 Sec.
3— 100 KVA Whse. 1 Ph., 13,200V—220/440.

SYNCHRONOUS MOTORS
1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G. E., 1800 RPM, 220V, 3/60
2— 150 H.P., Al. Chal. 360 RPM, 440V, 3/60

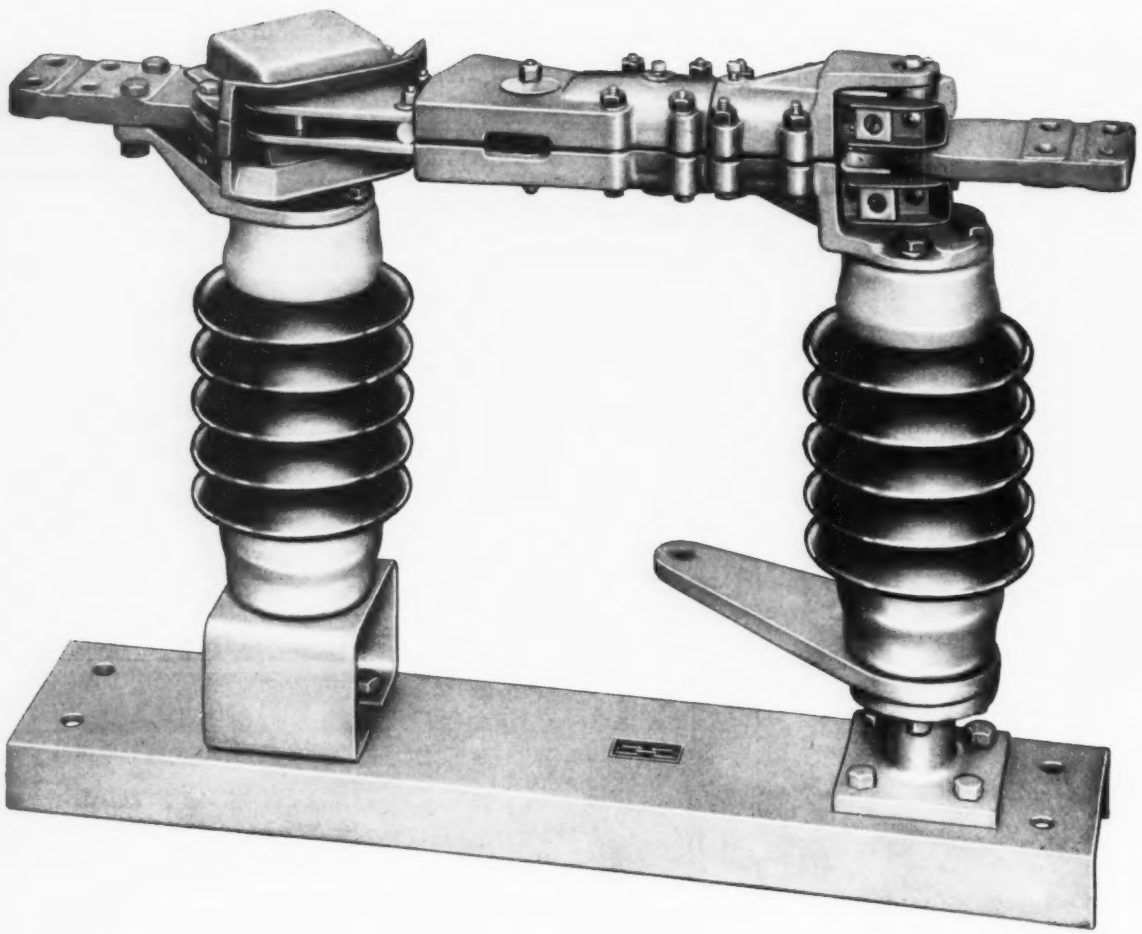
MOTOR GENERATOR SETS
1—1000 KW Whse., 600 V 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000V Syn.
1— 200 KW Whse., 275V. 900 R.P.M., 220 V Syn.
1— 176 KVA West., 1Ph., 220V. Motor 3Ph., 440V.
1— 150 KW G.E., 126/250V. 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

SLIP RING MOTORS
1— 400 H.P. West. CW, 450 RPM 550V.
1— 250 H.P., West., CW, 600 RPM, 440V.
1— 200 H.P., West., CW, 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3Ph. 60 Cy.
1— 100 H.P. G.E., MT 600 RPM 440V.

Large Stock of A.C. and D.C. Equipment

Cole Electric Co.

8439 Steller Drive | TExas 0-4701 | Culver City, Calif.



OUTDOOR DISCONNECTING SWITCH

15,000 Volts—1200 Amperes—Type LU

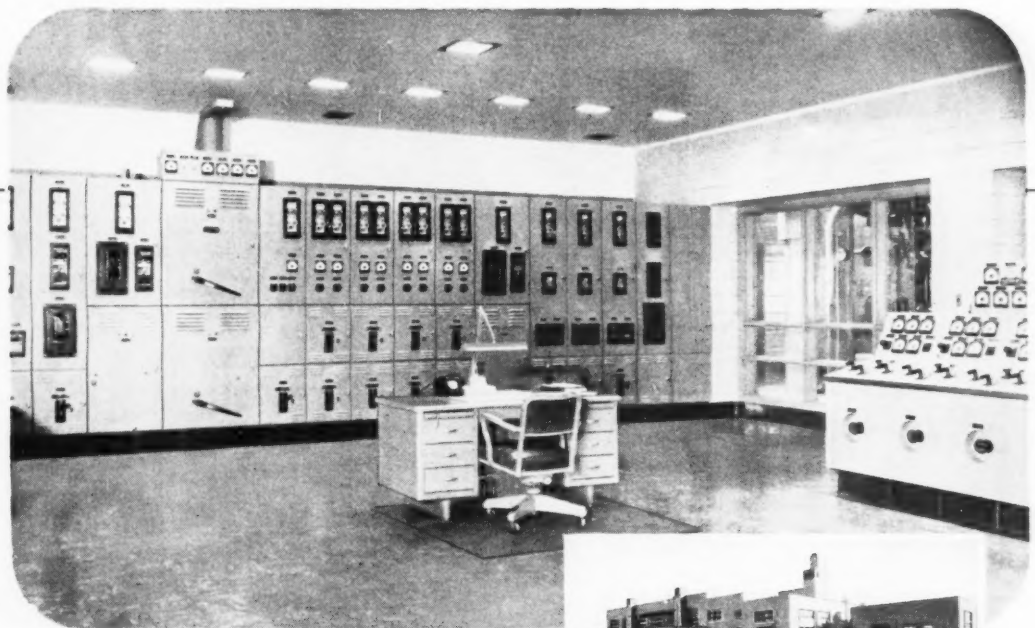
Side Break—Three Pole—Single Throw—Group Operated

SILVER TO SILVER CONTACTS

One Pole Shown

See Bulletin 42A

It's Federal Noark® electric controls in Nassau County's ultra-modern disposal plant



ABOVE: General view of the electrical control room with Federal Noark switchboard and special generator control benchboard. RIGHT: Nassau County's new sewage treatment and disposal plant . . . completely efficient and immaculate. Electrical Contractor, E-J Electric Installation Company, New York, N. Y. Consulting Engineers, Greely and Hansen, Chicago, Ill.

NASSAU COUNTY, NEW YORK, has opened a new sewage treatment and disposal plant that is the last word in efficiency. It's dual-fuel engines burn either sewage gas or oil. A Federal Noark main generator and distribution switchboard, control panels and benchboards provide centralized control of lighting circuits and of the outlying Federal Noark control centers that operate the pump and sewage motors, purifiers, grit chambers and other equipment.

Federal Noark switchgear, control panels and benchboards are being chosen more and more frequently to provide the most simple and effective method of electric circuit control. Much of this equipment is composed of standard units which are quickly and economically assembled . . . and such standardization assures lowest installation costs and maximum flexibility for future changes and expansion.

Whether planning a new installation or modernizing an old one, you, too, may find that Federal Noark offers the best value obtainable today.

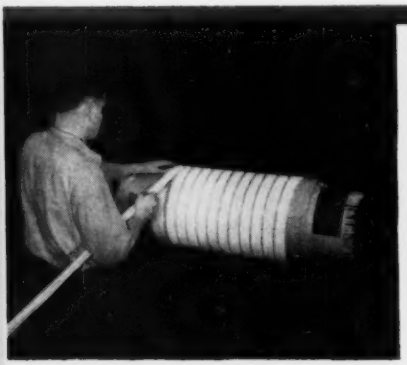
FEDERAL ELECTRIC PRODUCTS COMPANY, 50 PARIS STREET, NEWARK 5, NEW JERSEY

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

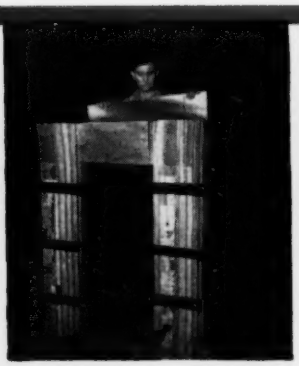
FEDERAL NOARK®

Federal NOARK

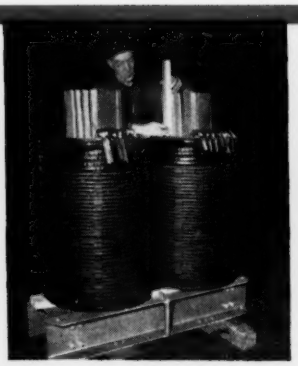
This is how *Kuhlman* craftsmanship assures you dependable transformers



1. The coils of Kuhlman power transformers are usually wound concentrically. Coils that are to carry heavy currents at low voltage are of the interleaved disc type. Above, a cylindrical LV core for a 1000 KVA transformer being wound with multiple wires transposed when necessary to maintain low stray losses.

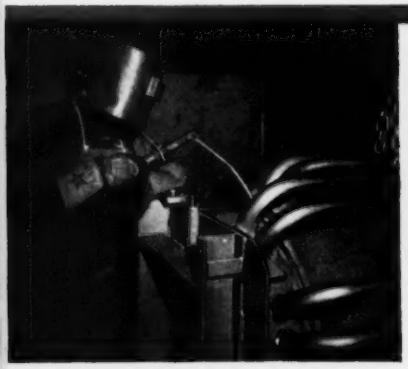


2. Assembling the core for a 1000 KVA transformer. After the assembler has finished inserting the laminations, the core will be inverted to receive the coils. The laminations are made of cold-rolled oriented silicon steel which permits the flux path to follow the grain of the steel producing high permeability and low hysteresis.



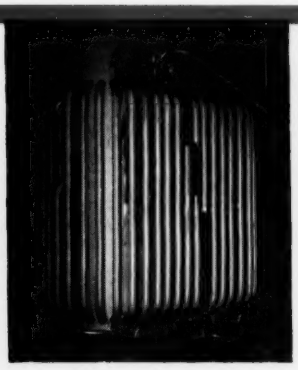
3. Here the core has been inverted and assembled to the lower part of the core clamp. The coils, which have been immersed in a thermo-setting varnish and baked, have been slipped over the legs of the core. The assembler is bracing the core to prevent shifting and vibration.

4. After the core has been braced, the assembler inserts the necessary laminations on top to complete the core. After this, the remainder of the core clamp will be assembled and the core and coil assembly will be ready to be lowered into the tank.



5. The tank is made of heavy steel plate, electrically welded at the seams. Here you see the cooling tubes being welded on the outside of a tank to provide oil-tight and rust-proof joints.

6. In this picture, the welded joints of the cooling tubes are being tested for leaks. After these tubes are put on the tank, the entire tank is filled with kerosene and subjected to air pressure as a final check to determine if the tank is completely oil-tight.



7. Finally, the entire tank is shot-blasted and painted with a coat of rust-inhibitive primer and two coats of corrosion resistant paint. The tanks are then ready to receive the core and coil assembly.

8. Kuhlman transformers are engineered for long life and dependability. They are built from carefully selected materials according to sound principles of design and assembled with infinite care and patience by skilled craftsmen with years of experience at their job. Then each transformer is thoroughly inspected and tested for safe, efficient performance. When you install your next transformer, specify Kuhlman for transformers of outstanding quality — backed by nearly 60 years of electrical manufacturing experience. Write us today for the name of your nearest Kuhlman representative.

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